

# Emigration of Highly Skilled Labor: Determinants & Impacts

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# *Emigration of Highly Skilled Labor: Determinants and Impacts*

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# Abstract

This is an additional contribution to the large body of literature developed in the area of economics of skilled labor migration. It focuses on two major objectives that are the determinants of the migration and its likely impacts on developing economies. Within the framework of the new economics of skilled labor migration, this research has attempted to test empirically the relevance of some components of the most recent new economic models of skilled labor migration. Using available data from international organizations (World Bank, OECD, UNESCO…) and others, in both regressions analyzes and economic simulations, hypotheses have been tested and directions of empirical results identified for larger policy discussions. The theoretical models that have been given priority in these empirical investigations are mainly those of Beine & al, Stark (2005) & al, N. Duc Thanh (2004) and M. Schiff (2005). A major focus has been placed on the models suggested by Duc Thanh (2004) where useful specifications of the functional forms were made. This selected framework uses the similarities that have been observed between this model and that of Stark and Schiff.

The empirical results that have been obtained confirm the role of relative wages, the availability of better opportunities such as jobs, the importance of the living conditions as well as the existence of more attractive working conditions in destination countries relative to source economies. Concerning the estimation of the impacts of skilled labor migrations for both developed and developing economies, the specifications have followed Beine, Stark and Duc Thanh models with special emphasis placed on this latter. Given the dynamic nature of Beine's model and with the limits on the available time series, significant empirical results are obtained and tests of Beine's propositions achieved. The regressions results using the subcomponent of the knowledge economic index have shown significantly the effects of both domestic education and the attractiveness of foreign relative wages as major determinants that support the explanation of the level of knowledge added by the tertiary sector in each economy. In the sense of these estimations, it appears clearly that any economy is under two major opposite effects. On one hand, there is the relative share of investment in education that affects positively the human capital formation in any country but with higher impact in developing economies. On the other hand, there is the magnitude of the relative wages that negatively affect the performance of developing economies as measured by the subcomponent of the knowledge economic index. These results have been first confirmed through regression analysis.

These preliminary findings suggest that local, national, regional and international economic policies consider the new theoretical and empirical trends shown so far by these results.

# Introduction

This paper looks at the determinants and impacts of the migration of skilled labor from developing (South) to developed economies (North). In the absence of cross-section data about individual and group choices, only aggregate secondary and incomplete data can be used to understand and assess the overall determinants and impacts of the migration of skilled labor. The available publications related to the migration of skilled labor with its relationship to economic and social development show the diversity and richness of the material developed so far. The accumulated knowledge focuses on the perception and loss of qualification at the source of emigration with emphasis on the potential gains transferred to destinations. It also insists on the perceptions related to the educational and training costs invested at the origin and to the experience accumulated by the emigrant, mainly when public budgets and expenditures are involved. The overall direct and indirect benefits and costs that are related to the processes of emigration of skilled labor have also constituted important components in the economic literature. Finally, it can be derived from the accumulated knowledge that the higher intensity of emigration of skilled labor from the same given sources has shown a large body of reports and publications indicating the directions of losses and gains between developing and developed economies especially in the era of globalization and increased competitiveness and where knowledge is the most important driver (Driouchi & al, 2006).

This paper starts with a comprehensive literature review about the determinants and the impacts of the migration of skilled labor. This is followed by a description of the methods and data used to assess both the determinants and the impacts using some selected models. The results obtained are then submitted before tackling their discussion with the implied economic policy issues.

# I. Literature Review

Different approaches to migration have been identified and different assessments have been developed. These approaches are mainly based on the relationship between developing and developed countries with the possibilities of enhancing the likely benefits that can be obtained from this migration. In relation to that, some authors have considered the brain drain to be negative to developing economies while others have been more in favor of negotiated solutions as gains are observed to occur to source countries. This latter literature is now progressively shaping international and national policies.

### 1. Determinants of skilled workers' migration

The large body of reports developed by the International Labor Office has been useful in understanding series of economic, social and policy issues related to human migration in general and to skilled labor in particular. Report 44 by Lindsay Lowell and Allan Findlay (2002) underlines the absence of databases that directly deal with high skilled labor migration. Report 73 by Gloria Moreno-Fontes Chammartin & Fernando Cantù-Bazaldùa (2005) has set some prospects for migration in the context of the enlargement of the European Union. The prospect for skilled labor migration is high as workers are supposed to settle where their

productivity and wages are higher. The factors behind this high prospect include income gaps, the social and the network systems and the attractiveness of the educational system in Europe. The existing literature recognizes that the "brain drain" is another aspect of international mobility that worries researchers and political leaders, from the North and the South, and emphasizes the idea of cooperation between labor transmitting and labor receiving countries.

## 2. Effects of Brain Drain on the welfare and growth of source countries

The work concerning the international emigration of skilled labor force, considered as talent drain from the least developed economies towards the most developed, had rather unanimously advanced following the idea that brain drain is unfavorable to the development of the source economy (Bhagwati & Hamada, 1974). The principal arguments justifying this situation are related to different types of externalities, induced by the migration of human capital, which are imposed on the remaining population. Bhagwati and Hamada (1974, 1982) show that the emigration of the most skilled labor force generates a tax externality associated with a distortion of the optimal tax system on two levels. On the one hand, knowing that the most skilled agents are better remunerated, government loses in terms of tax income due to its agents' drain, which affects the potential size of revenue redistribution. In the same way, the investment in terms of education and training represents major costs for developing countries which cannot receive benefits in return since the migration of skilled labor takes place.

Bhagwati and Dellalfar (1973) proposed a tax on professional emigrants' income for an approximate period of their ten first years in the host country. This tax is supposed to be collected by UNDP and distributed in the countries of origin. However, there are administrative problems associated with tax collection, the problem of non-benevolent developing governments, and the extent to which a brain drain tax should be integrated in the tax system of the country of origin. To avoid these problems, a small tax on the incomes of citizens living abroad was considered as a possible approach in collecting a brain drain tax (Wilson, 2005).

Bhagwati and Partington (1976) and Bhagwati (1976) discuss the feasibility of the tax on residents' income in the host country. This tax cannot be gathered by all developed countries (different political systems and constitutions) but might be collected by developing countries through a multilateral treaty. Maynard (1976) criticized the depth of analysis of Bhagwati and co-authors regarding the definition of developed and developing countries, the definition of equity in terms of distributing resources, the compensation principle (10% tax for 10 years), the over production of professional and technical personnel by underdeveloped economies, and the efficiency of the international redistributive mechanism (free riders, efficient use of funds).

The effect of asymmetric information was introduced by Kwok and Leland and commented by Katz and Stark. Asymmetric information in labor market according to Kwok and Leland is the reason behind the brain drain in less developed countries. Since employers abroad are better informed about workers' productivity than domestically, they offer better wages making skilled employees prefer to stay abroad. However, under alternative scenarios of asymmetric information, less skilled workers migrate from less developed countries more than highly skilled labor. Depending on which side the information is present (rich or poorer country), asymmetric information tend to encourage migration. From the side of a poorer country (ex. Taiwan), the asymmetric information may support low-skilled workers' migration. From the rich country side (ex. USA), asymmetric information might cause the migration of highly skilled workers (Katz & Stark, 1984).

In their reply to this, Kwok and Leland found that the example of Katz and Stark is another result of their research: skilled workers will stay in their home country while less skilled workers might migrate, if reverse information asymmetries exist (if the poorer country can better screen its workers than the rich one). When sufficient wage differential is available, emigration of the least talented workers can occur but will often be partial. Migration and government policies affecting mobility can then be discussed in relation to informational asymmetries and relative wages (Kwok & Leland, 1984).

Blandy (1968) constructed a model through which he assessed the brain drain phenomenon. He found out that migration is multidirectional (not only into North America) and is a complex movement attached to political, economic and educational development processes. Two conditions should hold to conclude that brain drain exists. The first condition is when the migration of highly skilled workers is growing more rapidly than the number of highly skilled labor in the home country. The second is when the difference between these rates of increase is greater than the difference between the rates of increase of migration as a whole and the economically active population as a whole.

According to the endogenous growth theory, the migration of competencies imposes an externality whose origin lies in the reduction of local human capital stock available for present and future generations. This implies a negative effect on the income of workers who didn't emigrate or on the growth rate of the source country. Moreover, qualified work is an instrumental factor in attracting foreign investments (Fujita et al. 1999) as well as in the capacity of assimilation and absorption of technological externalities or for the success of foreign technologies adoption (Benhabib and Spiegel, 1994).

Furthermore, within the framework of the new theory of endogenous growth, the human capital drain is unfavorable to development (Miyagiwa, 1991; Haque and Kim, 1995) since the loss in human capital resulting from skilled workers emigration decreases productivity and income per-capita. Miyagiwa (1991) for example, shows that in the presence of increasing outputs from education, the emigration of very skilled workers can decrease the income of workers with intermediate skills either these latter migrate or not. Under certain conditions, this author shows that the national income of the source country can be lower than the one that would prevail in the absence of migration. Thus, the brain drain was identified as a serious problem against which policies had to and could act. Haque and Kim (1995) think that education policy is the answer. Since educated people are more likely to emigrate, in an open economy, then education should focus en primary and secondary levels. Even though remittances counterbalance the effects of brain drain, Haque and Kim (1995) found that these remittances have a negative effect on the growth of the home country.

Using the simple economic model of labor demand and supply, Mishra (2006) assessed the quantity of welfare loss that results from labor movement both when external effects do not exist and when they do. When external effects of labor migration are not taken into consideration, the emigration loss is the surplus resulting from the difference between the cost of employing the workers who migrate and the value of their marginal product. This welfare loss is due to the cost imposed on those who were left behind. Accounting for external effects, Mishra (2006) found that the loss from skilled labor migration is greater than without external effects.

Very recently, the models and analyzes related to the negative impact of human capital migration, gave slowly the place to models and studies aiming at the identification of potential transmission channels through which the migration option as well as the possible money transfers could constitute a considerable source of income for the development process of the source country.

The new literature tries to show that potential net positive effects on human capital accumulation and growth that can be associated to human capital migration. Consequently, the unfavourable effect of the exodus of competencies can be reversed. Therefore, the expression "Brain Drain" becomes "Brain Gain". In this new literature, it is suggested that the brain gain could be associated with the inciting impact created by the migration prospect on the size of human capital formation in an environment of uncertainty. According to Mountford (1997), the migration possibility even if temporary might enhance the average level of productivity of the source economy in a permanent way. The general idea is that, in poor economies, the net yield of human capital tends to be limited, thus inhibiting the incentives to invest in education and training. However, open economies offering migration possibilities make the human capital acquisition more attractive since wages of skilled workers are higher in developed countries. This can lead to an increase of the medium level of human capital in the remaining population according to Beine et al. (2002). In this new literature, in a context of uncertainty and heterogeneous individual aptitudes, two brain drain effects are highlighted: a natural incentive effect to the human capital formation, and a rather drain effect which appears with the effective departure of the economy's talents. So, the human capital migration can be globally beneficial to the country of origin, when the first inciting effect dominates the drain effect by compensating for the negative direct impact of the brain drain on the human capital stock of the considered country.

A survey of the empirical and theoretical literature, done by Docquier and Rapoport (2005), on skilled migration effects on developing countries stated that the level of development for a country is inversely related to its optimal rate of migration. Furthermore, education policy strengthens the possibility of a beneficial brain drain, given that education is partly publicly financed through education subsidies. The fiscal adjustments to the brain drain can lead to tradeoffs between efficiency and social justice. That is why Bhagwati's tax can represent more benefits for the sending countries when investments in education are liquidity constrained (Docquier & Rapoport, 2005).

Grubel and Scott (1966) already said that if the human capital migration is a social cost in the short run, it is possible that this cost can, under certain conditions, be largely compensated in the long run through the transfers' potential, and the beneficial impacts emanating from the professional networks set abroad. There are two ways of carrying out the 'brain gain': either through the return of migrants to their country of origin (return option), or through their mobilization by associating them remotely to the development of their country of origin (network of experts' option). The return option was successfully carried out in various newly industrialized countries such as Singapore, Taiwan, Hong Kong and Korea. The theoretical results of the new literature thus corroborate the argument of Grubel and Scott (1966), and suggest that the impact of emigration on the source countries could be rather positive. Consequently, in terms of economic policies, these works quite naturally encourage developing countries to open their borders, and to authorize migration in order to maximize its positive effects.

Oded Stark also brought another perception of the brain drain. Since the familial and capitalist production functions are imperfect substitutes, migrant children might provide a positive role in the economy. An agricultural family that decides to move from "familial production" to "capitalist production" faces two constraints: "investment capital" constraint and risk constraint. The family tries to find solutions to the market imperfections it faces by driving the most suitable family member to rural-urban migration. This migration diminishes risks, given that the urban work is independent of agricultural production. Children are seen to yield different utilities: consumption, income, and status, security & insurance. However the role of the migrants is to cause technological change by increasing income. Education allows such

scenario, given that farmers use the educational system to prepare their children for migration. The total utility from children is increased when specialization by children in the different utilities production exist. A social-welfare implication arises given that private optimal behavior (family) doesn't differ from the social optimal behavior (Stark, 1981).

In his review of "The Migration of Labor", Todaro (1991) emphasized Stark's belief that migration is initiated by family decisions. Stark believes that migrants are driven by the wage differential, expected income and other factors and that migration is the result of incomplete and imperfect markets. Korner (1992), who has done the same review, presented Stark's findings according to which, the individual-family cooperation and the markets' mode of functioning are the causes of migration. This latter occurs when a group of people, determined to rationally allocate common resources, make economic decisions. So, migration is seen as a way to alleviate risks and is due to national and international market imperfections as well as institutional distortions. Stark also connects migration to information regimes, risks, remittances and economic performance of the migrants (Korner, 1992). In addition, Molho also identified from Stark's "Migration of Labor" that many factors, such as highly imperfect markets in rural areas, credit access constraints, and risks and hazards, drive small farming families to send their most eligible member to urban areas or, in a more general sense, to migrate. The remittances sent by the migrant can alleviate risks related to new investments (in technology for farm production). Stark studied the role of relative depravation as well as that of information asymmetries when employers are faced with workers whose skills' level is undetermined. Concerning the theme "Planning with migration", Stark found out that government efforts to decrease labor movements were unsuccessful and that this phenomenon might be beneficial in a social framework. The economic performance of migrants depends on migrants' characteristics, on informational asymmetries driving the migrant to take self-employment risks and to save in case of return migration (Molho, 1992).

Stark also identified the effect of one migrant altruistic relation with his family members or social group on his allocations and wellbeing and estimated the impact of the timing of intergenerational transfers of allocations on the recipients' human capital formation. Stark found that the altruistic behavior of the migrant and his family can be driven from self-interest since the actual transfers of the migrant to his family might influence future transfers from his own children (Todaro, 1997).

In another paper, Galor and Stark found that the probability of return migration affects migrant's savings and economic performance. Compared with the native-born, migrants' savings can decrease even with a small return probability (a decrease of the migrant's wage). The model adopted by these two authors defines saving patterns between the migrants and the native-born. Therefore, the higher the probability of return migration, the higher is the level of savings. As a consequence of the possibility of return migration, migrants save more than the native-born. If return migration does not take place, migrants' wealth outweighs the wealth of the native-born (Galor & Stark, 1990). This relationship between the possibility of return migration and the migrants' saving behavior can explain the migrants/native-born performance: if return migration doesn't occur, the migrants' performance will be superior to the native-born one. Also, migrants with a positive probability of return will have higher mean incomes than the native-born, but if they decide to transfer some of their savings as remittances, the migrants/native-born differential will decrease. Migrants contribute more to capital formation in the source country compared with the native-born. That is why country policies should keep the return probability higher than 0 (Galor & Stark, 1990).

Stark's research considered the good results of a smart migration policy called 'brain gain'. His theory resides in the fact that the prospect of migration may result in the formation of a socially desirable level of human capital. The expected higher returns to human capital in the

destination country influence the decisions about human capital skills' acquisition in the source country. So, a well-structured migration facility can enhance the social level of human capital formed, either all individuals can migrate or only a group of them. Therefore, migration can result in a welfare gain for the non-migrants (Stark, 2005).

The destination country has the power to form migration policies that maximize the natives' welfare when migration control is expensive. Thus, the evaluation of the impact of migration on the home country showed that this country can still benefit from the prospect of migration. However, a more important welfare gain can be achieved if both the home and destination countries cooperate in establishing the migration policy. In terms of bilateral migration agreements, sharing the cost of migration control can improve welfare (Stark et al., 2005).

However in spite of the theoretical premises of the present models, the robustness of the rare empirical studies that report the inciting effect of migration on the human capital formation still needs a final conclusion. Indeed, the only existing empirical studies about the bond between migration, investment in human capital and growth are those of Beine et al. (2002), and Faini (2002).

According to Carrington and Detragiache (1999), it is widely known that a large number of scientists, engineers, physicians and other professionals from developing countries live and work in the United States, Canada and Western Europe. Besides, developing countries lack highly educated workers. This is what was called Brain Drain since the 1960s. Highly educated people (individuals with tertiary education) have the highest migration rates. However, in Central America and Mexico, the highest migration rates are those of individuals with secondary education. The large magnitude of brain drain from Iran, Korea, the Philippines and Taiwan shows that the movements of highly educated individuals in from developing countries can more be ignored. The data of the OECD continuous reporting system on migration was used to estimate the brain drain to OECD countries except USA but this data presents many problems. The reason behind so many skilled workers emigration from developing countries can be the differences in wage, quality of life, and education opportunities for children, job security and others. Another issue is the extent of education benefits for developing countries' citizens that can control the brain drain (Carrington & Detragiache, 1999).

Starting from a sample of 50 countries, Beine et al. (2002), who brought an innovation to the brain drain literature with their empirical results, show that the rate of emigration of the most skilled, positively and significantly influences human capital accumulation and growth. Most countries that are positively affected by the brain drain combine both low levels of human capital and low emigration rates for the highly educated. Negative growth countries appear in countries where 20% and up of the highly educated migrate and/or where up to 5% of the total population are highly educated. Both winner and looser countries exist, but the proportion of winners includes the largest countries in terms of demographic size (80% of the total population of the sample). Empirical studies showed that at an aggregate level, brain drain is not anymore seen as extractor of the most valuable human resources from poor countries, but needs a better understanding of the conditions and causes of negative brain drain. An extension for this research could include, in addition to education, remittances and business networks' creation.

However, Faini does not validate this result in his study. He didn't find convincing proof about the bias that skilled migration in destination countries can benefit home economies, especially because of the globalization process that is harmful to poor countries. He also stated that a more liberal skilled migration policy can have an unfavorable effect on tertiary enrollment which contradicts the possible increase in the return to secondary education. Thus, return migration does not necessarily have an evident beneficial impact. Therefore, policy

makers are expected to strengthen multilateral trade systems and limit the repetition of financial crises in emerging economies (Faini, 2003).
Schiff (2005) minimizes the size of the brain gain and its effect on growth and welfare compared with the new brain drain literature. The size is smaller because of heterogeneity, unskilled migration, uncertainty, brain waste and general equilibrium effects. The brain gain is smaller (or negative) with limited impact on welfare and growth. He shows that brain drain exceeds brain gain in constant state and agrees with contributors to the early brain drain literature, who viewed brain drain as a trigger of loss for the home country. The author agrees with the new brain drain literature on one point related to the most severe brain drain cases where the net brain gain is negative (Schiff, 2005).
Even at the theoretical level, it seems that the literature on this subject is hesitant since the available models are specific enough to be able to show in a rather general way that the net impact of migration on the source country is always positive in term of human capital formation. In a series of papers, Stark et al. insist on the development of the migration prospect as a mechanism that can account for the externality associated with human capital. Within the theoretical framework of Lucas (1988), Stark et al. took over the idea of Mountford (1997) to show – using simple static models – that a well specified migratory policy can correct the human capital under investment in a decentralized balance, and ensure a well being gain for workers. The result according to which the stock of the national average human capital approaches the socially optimal level is not shown in their work although they analyse human capital externality and treat migration as a mechanism of internalization.
According to Stark (2002), the decision to under-invest in costly human capital formation may be reached if an individual productivity is fostered by the average level of human capital in addition to his own human capital (in a closed economy), and thus affects social welfare. Migration can allow the formation of human capital at a socially desirable level. Besides, acquiring skills enhances the chances of having high skills rewarded. Grubel and Scott didn't refer to the relationship between migration and welfare gain for the non-migrants even though they mentioned that emigration should be encouraged given that the emigrant improves his own income and that those who remain behind are not affected by the migrant's departure (Stark, 2002). He also demonstrates both results of the prospect of migration: brain drain and brain gain and he found that a good migration policy can lead to welfare gain for all workers.
The debate that turned over the advantages and costs of skilled migration resulted in many analyzes. It should be recognized that this kind of migration is costly in terms of the country of origin's finances and economy.

# II. Methods of Investigation

These methods are mainly those that helped assess respectively the determinants and the impacts of skilled labor migration. Besides the theoretical grounds on which each investigation has been conducted, the empirical models used are respectively based on regression analysis and simulations. The data are mainly aggregates from a diversity of sources. More details are provided below relative to both the determinants and the impacts of skilled labor migration.

### 1. Factors that could explain the emigration of skilled labor

The available reports and publications show that there are many factors that could explain the emigration of skilled labor to other destinations. The number of these factors is recognized to

have increased with globalization and with the development of competitiveness through knowledge and ownership of skills. The liberalization and openness of economies relative to the period of government intervention are also among the factors that contributed most to the enlargement of the set of likely explanatory variables that are behind emigration. In this context, subsets of current variables are provided in reports and publications.

Relatively to the levels of variables in the source countries, the likely factors include the expected monetary gains, the living conditions, the working conditions, and the state of human rights, the accessibility to the emigration costs, and the accessibility to information, quicker promotion and acquisition of social status with easier access to networks and to professional support. Furthermore, the absence of jobs and decent occupations in the source country leads automatically skilled labor workers to search for opportunities elsewhere. Destination countries offering better opportunities are then selected for emigration.

In this context, a first type of emigration of skilled labor is from developing economies to the developed ones. The second type is related to migration between developed economies. It is mainly the first type of emigration that is the focus of this report. The determination of the likely factors that have affected the emigration will be based on the above listing of factors, starting with labor market variables and ending with the inclusion of social and human rights variables. This determination is largely inspired by the report on global migrations (2005) that recognized that wages disparities, unemployment rates, differentials in life expectancy, education gaps and demographic gradients are among the major determinants of migration.

## 2. Models used to assess impacts

The models adopted in the measurement of skilled labor migration impact on source and destination countries, in terms of human capital formation and growth, are divided into theoretical and empirical studies.

The model presented by Beine, Docquier and Rapoport (2002) is an empirical assessment of the growth effects on home countries of skilled labor migration. Beine et al. used Carrington and Detragiache data (1998) concerning the emigration rates at three educational levels for a set of 50 developing countries. The results of this empirical study showed that brain drain can be beneficial as well as disadvantageous for the source countries. In addition, given that it is possible for brain drain to generate benefits for the source country, it is necessary to expand studies to means other than education.

**Table 1: Beine et al. Results "Brain Drain and LDCs' Growth: Winners and Losers"**

| Models | Description and Analysis |
|---|---|
| $c_i(a) = c(a, \chi_i^h)$, with $c_a^{'} < 0$ | The higher the personal ability of an individual, the lower is the cost of achieving the minimal education threshold, which also depends on other country-specific variables affecting human capital. |
| $rel_i = m_i\omega^* + (1 - m_i)\omega_i^d$ | The expected return to education is the weighted average of the relative return abroad and in the source country with *m* being the probability of skilled migration. |
| $\omega^* > \omega_i^d$ then, $\frac{\partial rel_i}{\partial m_i} > 0$<br>$H_i = 1 - F(a_i^*)$ | The equilibrium proportion of educated agents in a country, where $a_i^*$ is the ability of the worker indifferent as to whether to invest in education. Assumption: education investments in a given country can explain a higher initial level of human capital inherited by the following generation. The ex-post proportion of educated workers within the previous generation. |
| $hum_i = \frac{(1 - m_i)[1 - F(a_i^*)]}{1 - m_i[1 - F(a_i^*)]} = \frac{(1 - m_i)H_i}{1 - m_i H_i}$<br>$g_i = g[hum_i, \chi_i^g]$<br>**Proposition 1** | The human capital growth rate equation shows two effects: the brain effect and the drain effect.<br>The first term between brackets measures the negative effect and the second term measures positive (brain) effect.<br>The ex-ante proportion of educated workers in the total population.<br>These two equations are used to estimate the global effect of the brain |

| | |
|---|---|
| $\frac{dg_i}{dm_i} = \frac{\partial g_i}{\partial hum_i} \times \left[ \frac{-\left[1-F(a_i^*)\right]F(a_i^*)}{\left\{1-m_i\left[1+F(a_i^*)\right]\right\}^2} + \frac{(1-m_i)F'_a(-\frac{\partial a_i^*}{\partial m_i})}{\left\{1-m_i\left[1+F(a_i^*)\right]\right\}^2} \right] \gtrless 0$ | drain and evaluate the expected growth effect of a marginal increase in the migration probability. |
| $H_i = \frac{hum_i}{1 - m_i(1 - hum_i)}$ | The evaluation of the closed economy stock of human capital. |
| $\Delta H_i + d_H H_{i,lag} = \psi(m_i; \chi_i^h; \epsilon_i^h)$ | The growth effect of a marginal increase in the migration probability. |
| $g_i = \gamma(hum_i; \chi_i^g; \epsilon_i^g)$ | This condition is necessary for a brain drain to be beneficial to the source country. |
| $\widetilde{H}_i = Max\left\{\psi(0; \chi_i^h; \epsilon_i^h) + (1 - d_H)H_{i,lag}; 0\right\}$ | The net growth effect of the brain drain. |
| $g_i = \gamma\left(\frac{(1-m_i)\left[\psi(m_i; \chi_i^h; \epsilon_i^h) + (1-d_H)H_{i,lag}\right]}{1 - m_i\left[\psi(m_i; \chi_i^h; \epsilon_i^h) + (1-d_H)H_{i,lag}\right]}; \chi_i^g; \epsilon_i^g\right)$ | This condition is necessary for a marginal increase in the migration probability of the highly educated to be beneficial to the source country. |
| $\frac{\partial g_i}{\partial m_i} = \gamma_i^{hum} \times \frac{-H_i(1-H_i) + \psi_i^m(1-m_i)}{(1-m_i H_i)^2}$ | |
| $\psi_i^m(0; \chi_i^h; \epsilon_i^h) > \widetilde{H}_i(1 - \widetilde{H}_i)$ | |
| $\Delta g_i = \gamma\left(hum_i; \chi_i^g; \epsilon_i^g\right) - \gamma\left(\widetilde{H}_i; \chi_i^g; \epsilon_i^g\right)$ | |
| $\psi_i^m(m_i; \chi_i^h; \epsilon_i^h) > \frac{H_i(1-H_i)}{1-m_i}$ | |

Nguyen Duc Thanh (2004) continues with Beine et al. findings and presents a theoretical model including the heterogeneity of workers' talents. Stark's results move in the same direction as Duc Thanh's:

## Table 2: The model of Oded Stark, Alessandra Casarico, Carlo Devillanova and Silke Uebelmesser

| Models | Description and Analysis |
|---|---|
| **Open Economy**<br>$\tilde{W}^S(\tilde{\vartheta}^S) = m\,[\beta^D \ln(\tilde{\vartheta}^S+1)+\eta \ln(\overline{\tilde{\vartheta}}^D+1)]$<br>$+[1-m]\;[\beta^S \ln(\tilde{\vartheta}^S+1)+\eta \ln(\overline{\tilde{\vartheta}}^S+1)]-k\tilde{\vartheta}^S$<br>$\tilde{\vartheta}^{S*} = \frac{m(\beta^D-\beta^S)+\beta^S}{k} - 1$<br>$\tilde{\vartheta}^{S*} > \vartheta^{S*}$ but $\tilde{\vartheta}^{S*} < \vartheta^{D*}(=\tilde{\vartheta}^{D*})$ | Migration is assumed to have no cost of movement. The function of the expected net earnings of the workers in the sending country equals gross earnings given the probability of migration minus the costs of capital formation. The optimal level of individuals' human capital when the possibility to migrate exists is $\tilde{\vartheta}^{S*}$.<br>For any m between 0 and 1, the level of human capital in an open economy setting exceeds that of a closed economy setting, but it is below the level of human capital in the destination country. |

**Table 3: Duc Thanh Results "Heterogeneous Talent and Optimal Emigration" (2004)**

| Models | Analysis |
|---|---|
| $h_i = h_i(c_i, \tau_i)$ | The accumulation of human capital stock depends on the human capital investment expenditure and talent (The human capital formation function). |
| $\underset{(c)}{Max}(TU_i) = h_0 - c_i + E(U_i)$ | Workers' life income. |
| Closed Economy: $\mathrm{H}_0 = \mathrm{H}_0(h_0, \bar{f})$ | Human capital formation without emigration |
| Open Economy: $\mathrm{H}_E = \mathrm{H}_E(h_0, \bar{f}, \Psi, \omega)$ | Human capital migration with emigration |
| **A Model of Optimal Emigration**: $c_i^* = (\alpha\tau_i)^{\frac{1}{1-\alpha}}$ and $h_i^* = (c_i^*)^\alpha \tau_i = (\alpha)^{\frac{\alpha}{1-\alpha}} \tau_i^{\frac{1}{1-\alpha}}$ | The worker objective function, when there is no chance to emigrate. |
| $\mathrm{H}_0 = N\left( (\alpha)^{\frac{\alpha}{1-\alpha}} \int_0^\infty \tau^{\frac{1}{1-\alpha}} f(\tau) d\tau \right)$ | The aggregate human capital formation of the economy without emigration. |
| $E(U_{E_i}) = \omega(c_i^\alpha \tau_i)\pi + (c_i^\alpha \tau_i)(1-\pi)$ | The expected income with chance of emigration |
| $c_{iE}^* = [\alpha\tau_i(1+\gamma\pi)]^{\frac{1}{1-\alpha}}$ | The worker objective function, with emigration possibility. |
| $h_{iE}^* = (c_{iE}^*)^\alpha \tau_i = [\alpha(1+\gamma\pi)]^{\frac{\alpha}{1-\alpha}} \tau_i^{\frac{1}{1-\alpha}}$ | The aggregate human capital formation of the economy with emigration.<br>If $\pi = 0$, then $H_E = H_0$<br>If $\pi = 1$, then $H_E = 0$ (definitely free emigration) |
| $\mathrm{H}_E = (1+\gamma\pi)^{\frac{\alpha}{1-\alpha}} (1-\pi)\mathrm{H}_0$ | $\omega$ is the number of times the income of the successfully emigrating worker is higher than the same worker working domestically. The human capital formation function was assumed as: $h_i = c_i^\alpha \tau_i \quad (0 < \alpha < 1)$ |
| $\frac{\partial \mathrm{H}_E}{\partial \pi} = \mathrm{H}_E \cdot \left( \frac{[(\gamma+1)\alpha - 1] - \gamma\pi}{(1-\alpha)(1+\gamma\pi)(1-\pi)} \right)$ | The higher the probability of emigration π, the less is the human capital accumulation: 'Emigration Trap". |
| Since $(\gamma+1) = \omega$, then $\mathrm{sign}\left[\frac{\partial \mathrm{H}_E}{\partial \pi}\right] = \mathrm{sign}\left[\frac{(\omega\alpha - 1)}{(\omega - 1)} - \pi\right]$ | At $\pi^*$, the economy maximizes its domestic human capital stock: It is the optimal emigration probability. |
| **Proposition 1**: If $\omega \le \frac{1}{\alpha}$ | The net human capital gain will decrease.<br>The total effect will be zero since the this probability of migration achieves $H_0$ (no emigration) |
| **Proposition 2**: If $\omega > \frac{1}{\alpha}$ there exists a probability of emigration at $\pi^* = \frac{(\omega\alpha - 1)}{\omega - 1}$ | $\overline{\eta}$ can be considered as a threshold in emigration constraint policy. |
| When $\pi > \pi^*$: | Human capital formation without emigration. |
| At $\pi^{**}$: | Human capital accumulation with brain drain. |
| **A Model of Optimal Brain Drain:** assumptions $\pi = \frac{h - \overline{\eta}}{h}$ if $h > \overline{\eta}$, and $\pi = 0$ otherwise | |
| $\mathrm{H}_0 = \int_0^\infty h_0^*(\tau) n(\tau) d\tau = (\alpha)^{\frac{\alpha}{1-\alpha}} \int_0^\infty \tau^{\frac{1}{1-\alpha}} n(\tau) d\tau$ | |
| $\mathrm{H}_E = \int_0^{\overline{\tau}} h_0^*(\tau) n(\tau) d\tau + \int_{\overline{\tau}}^\infty \overline{\eta} n(\tau) d\tau$ | |

This model shows that the source country can experience a "brain drain trap", meaning that emigration constraints always result in a net brain drain effect. An optimal emigration exists at a given probability after which the country starts to lose its human capital.

Maurice Schiff (2005) presents other results focusing on the size of the brain gain that is smaller than the results presented in the other new brain drain literature, and thus the effect on growth and welfare are lower.

## Table 4: Maurice Schiff results

| Models | Description & Analysis |
|---|---|
| **Smaller Brain Gain: Partial equilibrium** | |
| $BG_t = BG(p_{t-1}),\ BG' > 0, BG'' < 0$<br>$p_1^e = p_0 = BD/S_0$<br>$S_t = S_{t-1} + \Delta S_t = S_{t-1} + (E + BG_t - BD)$<br>$= S_0 + \sum_{i=1}^{t}(E + BG_i - BD)$ | Where BG is the brain gain, BD is the brain drain (or numerical quotas to restrict entry) and S is the size of skilled population.<br><br>Where E represents people acquiring education before migration became an option. When E>BD, skilled population increases over time (not a brain drain problem). The brain drain problem prevails when E<BD. |
| If $E + BG_1 - BD > 0$, then $p_1 = BD/S_1 < p_0 = BD/S_0$<br>$BG_2 < BG_1$ and $\Delta S_2 < \Delta S_1$<br>If $\Delta S_1 = E + BG_1 - BD < 0$, then<br>$BG_2 > BG_1,\ \lvert\Delta S_2\rvert < \lvert\Delta S_1\rvert$<br>$S^P > S_0 > S^N$.<br>$\Delta S_j = \Delta S_k = E + BG - BD = 0$ | The stock of educated people $S_t$ increases at a decreasing rate until period $j$ where $\Delta S_j = 0$. The steady-state stock is $S_t = S^P$ for all $t \geq j$.<br><br>$S_t$ falls at a decreasing rate until period $k$ where $\Delta S_k = 0$. The steady-state stock is $S_t = S^N$ for all $t \geq k$.<br><br>In the steady state, the net brain gain is negative irrespective of the transition path. |
| **Heterogeneity:**<br>$A_{NM} = (A^* + A_{MAX})/2,\ A_M = (A^{**} + A^*)/2,\ A^{**} < A^* < A_{MAX}$<br>$S = (A^{**} - A^*)/(A^{**} - A_{MAX}) > p$ since $A_M < A_{NM}$.<br><br>$A_{MIG} = (A_{MAX} + A^{**})/2,$<br>When S = $p$ then $A_{NM} - A_{MIG} = (A^* - A^{**})/2$ | $A_{NM}$ represents the average ability level of the individual who acquired education under no migration choice. $A_M$ is the average ability level of the individual who acquired education when migration became possible.<br>$p$ is the migration probability.<br>$A_{MIG}$ is the average ability level of non-migrants from both the more able and the less able individuals.<br>When the number of skilled individuals in the source country is the same whether migration takes place or not, migration results in a lower effective human capital stock. |
| **Unskilled Migration:**<br>When $p = q = 0$ then $B_1 = W_S - W_U$<br><br>When $p > 0$ and $q = 0$,<br>$B_2 = (pW_S^* + (1-p)W_S) - W_U = (W_S - W_U) + p(W_S^* - W_S)$<br><br>When p, q > 0, $B_3 = (pW_S^* + (1-p)W_S) - (qW_U^* + (1-q)W_U)$<br>$= (W_S - W_U) + p(W_S^* - W_S) - q(W_U^* - W_U)$<br><br>$\Delta B_S \equiv B_2 - B_1 = p(W_S^* - W_S) > 0.$<br><br>$\Delta B_U \equiv B_3 - B_2 = -q(W_U^* - W_U) < 0$ | In the absence of migration, the education benefit or skill premium is $B_1$<br>$p$ is the migration probability of skilled labor; $q$ is that of unskilled labor.<br><br>$B_2$ is equal to the domestic skill premium plus the skilled labor migration premium multiplied by the skilled labor migration probability $p$.<br>$B_3$ is the domestic skill premium plus the skilled labor migration premium multiplied by the skilled labor migration probability $p$, minus the unskilled labor migration premium multiplied by the unskilled labor migration probability $q$.<br>A brain drain increases the expected return to education by the expected migration benefit: a brain gain appears (new brain drain literature).<br>When both skilled and unskilled labor can migrate, the expected return to education falls compared to the case where only the skilled can migrate: a smaller brain gain. |
| **Brain waste:**<br>i) $B_4 = W_S - W_U$ for $W_{BW}^* < W_S$,<br>ii) $B_4 = (pW_{BW}^* + (1-p)W_S) - W_U = (W_S - W_U) + p(W_{BW}^* - W_S)$ for $W_{BW}^* > W_S$<br>$\Delta B_{BW} \equiv B_4 - B_2 = p(W_{BW}^* - W_S^*) < 0, \partial W_{BW}^* / \partial BW < 0$ | B4 represents the expected benefit of education under skilled migration and brain waste (BW) conditions.<br>In case *i*, there is no brain drain or brain gain. In case *ii*, where a brain drain takes place, the difference in benefits without brain waste and with brain waste is $\Delta B_{BW}$. This income loss implies a smaller brain gain. |
| **Uncertainty:**<br>$U[p(W_S^* - C) + (1-p)(W_S - C)] > EU = pU(W_S^* - C) + (1-p)U(W_S - C)$<br><br>Given that $p(W_S^* - C) + (1-p)(W_S - C) > W_S - C$, under risk neutrality:<br>$U[p(W_S^* - C) + (1-p)(W_S - C)] > U(W_S - C)$.<br>Under risk aversion:<br>$EU = pU(W_S^* - C) + (1-p)(W_S - C)$ > or < $U(W_S - C)$ | The cost of education is $C$. The expected utility (EU) function represents risk aversion. The expected utility of education's benefit is smaller than the utility of the expected benefit (smaller brain gain).<br><br>Whether the expected utility from education with migration probability p is larger or smaller than that from education and not migrating is ambiguous. If it is smaller, there will be no brain drain, no brain gain and no brain drain problem. Once skilled migration is allowed by the destination country, risk aversion results either in a smaller brain-drain induced brain gain, or in zero migration and no brain gain. |
| **Negative brain gain** | |
| $E_U(W) = pW_U^* + (1-p)W_U$<br>$E_S(W) = pW_U^* + (1-p)W_S$<br>$(1-p)(W_S - W_U) < W_S - W_U$ | The expected wage rate for unskilled labor<br>The expected wage rate for skilled labor<br>The return to education in the absence of migration: the migration option decreases the return to education (negative net brain gain or net brain loss).<br>This result can be considered under less extreme forms of "brain waste". |

## 3. Description of the data used

Different databases are used to assess the impact of skilled labor migration on the sending country as well on destinations. The indices of skilled labor migration are taken from the most recent OECD database. There are five indices used: The highly skilled expatriation rate according to Cohen and Soto database for the population of 15 and plus (EM1), the highly skilled expatriation rate according to Barro and Lee database for the population of 15 and plus (EM2), the average of EM1 and EM2 (EM3), the emigration rate by country of birth - total population (EM4), and the emigration rates by country of birth for the population of 15 and plus (EM5). As specified in the above database, the highly educated emigration rate from a country is obtained by dividing the highly educated expatriate population from the country of origin by the total highly educated native-born population of the same country (Highly educated native-born = emigrants + resident native born), knowing that the highly educated correspond to those with a tertiary level of education.

Knowledge and socio-economic data are obtained from other databases and sources. The corruption perception index (CPI) is published by Transparency International. It is a composite index based on the corruption data in experts' surveys. The Index of Economic Freedom (IEF) is available at the Heritage Foundation. It measures how much a country is economically free by assessing its trade policy, government fiscal burden, intervention of government in the economy, monetary policy, capital flows and foreign investments, banking and finance, wages and prices, property rights, regulation and informal market activity (Heritage Foundation, 2006). The Knowledge Economy index (KEI) is obtained from the World Bank Institute. The KEI measures the degree of acquisition, creation, use and access to knowledge. It sums up indicators related to a country's economic incentive regimes, its innovation ability, its education system, and its information infrastructures. The Gross Domestic Product Index (GDPI) is a measure of the per capita level of income resources accessed by all the individuals in a given country. It was computed by IEAPS by normalizing the per capita GDP data and serves as a reasonable indicator of a country's wealth. The GDP is published in the Human Development Report 2005 by UNDP. The Human Development Index (HDI), also published by UNDP, measures the average achievements in a country in terms of a long and healthy life, knowledge and a decent standard of living.

Labor market variables including employment information are taken from the World Bank database, the index of tertiary education as a subcomponent of the education index included in the knowledge economic index is published by the World Bank Institute (2006). The investment per capita in higher education is measured by the expenditure per student devoted to tertiary education as percentage of GDP per capita (World Bank database, 2005). The relative wage in different immigration economies ($\omega$) is measured by relative GDP per capita (World Bank database, 2005). International Monetary Fund (IMF) database was also used.

# III. Empirical Results

### 1. Assessment of the determinants of skilled labor migration

The highly skilled expatriation rate according to Cohen and Soto database for the population of 15 and plus (EM1), the highly skilled expatriation rate according to Barro and Lee database for the population of 15 and plus (EM2), the average of EM1 and EM2 (EM3), the emigration rate by country of birth (total population) (EM4), and the emigration rates by country of birth for the population of 15 and plus (EM5). The first dependent variable here is EM3 the average of the two sets of data (EM1 and EM2).

All countries in the sample show results that link positively KEI and HDI, IEF and GDPI but the second regression indicates negative correlation between IEF and CPI. These results are consistent with the definition and the scales of each of the indices used in these regressions. Regarding the emigration rates as measured respectively by EM1, EM2 and EM3, they appear in each regression to be negatively related to both IEF and KEI meaning that the increase (decrease) in IEF leads to less (more) emigration or that the openness of the economy implies more incentives to emigrate. At the same time, increases (decreases) in KEI imply less (more) emigration. But the emigration rate is under the double effects of KEI and IEF. Given the three other relationships, the emigration rate is statistically assumed to decrease (increase) with the increase (decrease) of the human development index and with the increase of the corruption perception index. These results may be interpreted as saying that emigration increases with low human development and with corruption.

| **All countries in the sample** | **$R^2$** |
|---|---|
| KEI = 2.03 + 1.99 (HDI)<br>37.86 19.06 | 0.80 |
| IEF = 1.59 – 0.40 (CPI)<br>36.34 -13.18 | 0.66 |
| HDI = -0.08 + 0.33 (GDPI)<br>-3.86 18.34 | 0.79 |
| EM1 = 4.71 – 1.25 (IEF) – 0.85 (KEI)<br>6.53 -2.4 -4.79 | 0.21 |

| **All countries in the sample** | **$R^2$** |
|---|---|
| KEI = 2.04 + 2 (HDI)<br>41.19 19.82 | 0.80 |
| IEF = 1.63 – 0.43 (CPI)<br>43.03 -16.74 | 0.75 |
| HDI = -0.08 + 0.33 (GDPI)<br>-3.54 18.82 | 0.79 |
| EM2 = 4.88 – 1.52 (IEF) – 0.91 (KEI)<br>6.03 -2.68 -4.37 | 0.17 |

| **All countries in the sample** | **$R^2$** |
|---|---|
| KEI = 2.04 + 1.99 HDI<br>42.33 21.54 | 0.81 |
| IEF = 1.60 – 0.41 CPI<br>(41.04) (-15.11) | 0.68 |
| HDI = $-8.5*10^{-2}$ + 0.33 GDPI<br>( -3.86) (19.54) | 0.78 |
| EM3 = 4.18 – 1.13 IEF– 0.72 KEI<br>6.25 (-2.34) (-4.27) | 0.15 |

These results are better confirmed with the sample of developed economies for each of the dependent variables measuring emigration with stronger relationships between the emigration rates, IEF and KEI.

| **Developed countries** | **$R^2$** |
|---|---|
| KEI = 2.33 + 3.19 (HDI)<br>57.84 5.48 | 0.59 |
| IEF = 1.60 – 0.43 (CPI)<br>6.61 -3.67 | 0.39 |

| | |
|---|---|
| HDI = 0.3 (GDPI)<br>7.13 | 0.71 |
| EM1 = 20.61 – 3.82 (IEF) – 7.57 (KEI)<br>3.56 -2.91 -3.05 | 0.37 |

| **Developed countries** | **$R^2$** |
|---|---|
| KEI = 2.37 + 3.93 (HDI)<br>96.45 13.01 | 0.87 |
| IEF = 1.63 – 0.45 (CPI)<br>6.97 -3.93 | 0.38 |
| HDI = 0.46 (GDPI)<br>7.41 | 0.69 |
| EM2 = 7.51 – 2.57 (IEF)<br>2.42 -2.41 | 0.20 |

| **Developed countries** | **$R^2$** |
|---|---|
| KEI = 2.41 + 4.19 HDI<br>(57.56) (13.66) | 0.85 |
| IEF = 1.77 – 0.51 CPI<br>(17.32) ( -9.48) | 0.72 |
| HDI = 0.40 GDPI<br>25.14 | 0.95 |
| EM3 = 7.98 – 2.46 (IEF) – 2.11 KEI<br>( 5.6) ( -3.41) ( -4.34 ) | 0.37 |

Similar directions are observed among developing countries but with weaker relationship between emigration rates and KEI.

| **Developing countries** | **$R^2$** |
|---|---|
| KEI = 1.77 + 1.64 (HDI)<br>23.22 12.67 | 0.70 |
| IEF = 1.42 – 0.24 (CPI)<br>21.48 -4.19 | 0.21 |
| HDI = -0.14 + 0.29 (GDPI)<br>-4.18 12.97 | 0.71 |
| EM1 = 5.12 – 1.69 (IEF) – 0.71 (KEI)<br>5.52 -2.3 -3.6 | 0.18 |

| **Developing countries** | **$R^2$** |
|---|---|
| KEI = 1.79 + 1.63 (HDI)<br>23.73 12.48 | 0.70 |
| IEF = 1.51 – 0.31 (CPI)<br>29.37 -7.13 | 0.43 |
| HDI = -0.15 + 0.30 (GDPI)<br>-4.53 12.83 | 0.71 |
| EM2 = 4.87 – 1.58 (IEF) – 0.79 (KEI)<br>4.28 -1.83 -3.33 | 0.14 |

| **Developing countries** | **$R^2$** |
|---|---|
| KEI = 1.76 + 1.61 HDI<br>( 23.21) (13.29 ) | 0.71 |
| IEF = 1.47 – 0.29 CPI<br>( 25.70) (-5.75) | 0.30 |
| HDI = -0.18 + 0.84 GDPI<br>(-5.10 ) ( 12.40) | 0.68 |
| EM3 = 3.88 – 0.56 KEI<br>(4.17 ) ( -2.62) | 0.09 |

The overall results obtained show how economic (GDPI, IEF), social (HDI) and political variables (CPI) can explain the directions and magnitude of emigration from a given country. They clearly indicate that bad economic, social and political conditions explain the emigration as measured by the special two measures of skilled labor and their average.

**2. Other results**

Others results are based on the comparisons of the determinants of both the total emigration rate and that of skilled labor. The outcomes related to each of the dependent variables are

presented in the following table. These results confirm again the roles of the economic, social and political determinants as they have been shown in the first set of regressions.
Throughout these estimations of new determinants of skilled labor migration, it can be said that the new indices for knowledge, corruption perception and openness of the economy have been useful in capturing important information that appears to be useful explaining the emigration rates and mainly those related to skilled labor. Besides, these results, the previous studies have shown that the incentives provided by destination countries with even special fiscal policies, are also important drivers of emigration. Furthermore, the factors related to distance, proximity, language and the existence of colonial or historical ties with destination countries are also important factors that can explained the pull of skills from developing economies.

**3. Impact assessment of skilled labor migration**

The literature on skilled migration and the implications on human capital formation and growth rate are almost exclusively theoretical. The studies of Beine et al. (2001 and 2003) are empirical evaluations of the growth effects of the brain drain for the source countries of migrants. This paper uses the results of Beine et al. and applies this model to a set of 64 developing countries taking only the variables affecting human capital formation and growth rate.

Hence, using the growth effect of a marginal increase in the migration probability and proposition 1, we continue with the estimation of the parameters from the two-equation system above. The estimation results are given in the following table.

**Econometric estimations of Beine & al Model**

| **Developing countries** | | **R²** | **n** |
|---|---|---|---|
| Estimated equation: human capital | $\Delta H_{1990/2000} + d_H H_{1990} = \underset{(5.049)}{0.269}\, m'_{1990} - \underset{(-3.259)}{0.469}\, HDI_{1995} + \underset{(1.640)}{0.021}\, ASEExp_{2000}$ <br> $m'=(1+m)/(0.65+m^2)$ | 0.696 | 62 |
| Estimated equation: GDP growth | $GDPgrowth_{2000} = \underset{(4.679)}{5.011}\, hum_{2000} - \underset{(-4.029)}{1.692}\, hum^3_{2000}$ | 0.680 | 64 |

Based on the conditions imposed by the theoretical model, the different values defined above are calculated and applied to the situation of each country. The corresponding results that allow the knowledge of the overall impact of emigration are introduced below for a sub-sample of countries. More detailed list of results is presented in the appendix. Again, most of Beine's & al results are confirmed and that brain gains take place for all developing countries but only few countries do not benefit from increased emigration. The models of Stark & al and of N. Duc Thanh will provide further detailed results.

| | Cohen and Soto (2001) | | | | | | | Barro and Lee (2000) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Highly skilled aged 15+ | Hi0 (1-Hi0) | Deriv-Psi | Benef BD | Net grwt. Effct. | Benef Mg Inc | | Highly skilled aged 15+ | Hi0 (1-Hi0) | Deriv-Psi | Benef BD | Net grwt. Effct. | Benef Mg Inc |
| 15 non-OECD countries with the highest percentage of highly skilled 15+ expatriates in OECD countries | Brazil | 0.017 | 0.242 | 1.456 | Benef. | 2.036 | true | Brazil | 0.012 | 0.242 | 1.481 | Benef. | 2.036 | true |
| | Myanmar | 0.017 | 0.243 | 1.456 | Benef. | | | Thailand | 0.014 | 0.230 | 1.471 | Benef. | 2.085 | true |
| | Indonesia | 0.019 | 0.198 | 1.446 | Benef. | 2.152 | true | Indonesia | 0.015 | 0.198 | 1.466 | Benef. | 2.152 | true |
| | Thailand | 0.019 | 0.230 | 1.446 | Benef. | 2.085 | true | Paraguay | 0.018 | 0.232 | 1.451 | Benef. | 2.125 | true |
| | Bangladesh | 0.02 | 0.238 | 1.441 | Benef. | 1.738 | true | Argentina | 0.018 | 0.230 | 1.451 | Benef. | 2.226 | true |
| | Paraguay | 0.02 | 0.232 | 1.441 | Benef. | 2.125 | true | China | 0.024 | 0.226 | 1.421 | Benef. | 2.218 | true |
| | Nepal | 0.021 | 0.233 | 1.436 | Benef. | 2.187 | true | Myanmar | 0.024 | 0.243 | 1.421 | Benef. | | |
| | India | 0.031 | 0.233 | 1.385 | Benef. | 2.657 | true | Peru | 0.027 | 0.247 | 1.406 | Benef. | 2.176 | true |
| | Bolivia | 0.031 | 0.250 | 1.385 | Benef. | 2.327 | true | Nepal | 0.029 | 0.233 | 1.396 | Benef. | 2.187 | true |
| | China | 0.032 | 0.226 | 1.380 | Benef. | 2.218 | true | Bangladesh | 0.03 | 0.238 | 1.390 | Benef. | 1.738 | true |
| | Jordan | 0.032 | 0.248 | 1.380 | Benef. | 2.495 | true | Bolivia | 0.031 | 0.250 | 1.385 | Benef. | 2.327 | true |
| | Venezuela | 0.033 | 0.239 | 1.375 | Benef. | 2.644 | true | India | 0.034 | 0.233 | 1.370 | Benef. | 2.657 | true |
| | Costa Rica | 0.04 | 0.250 | 1.339 | Benef. | 2.101 | true | Egypt | 0.034 | 0.242 | 1.370 | Benef. | 2.606 | true |
| | Syria | 0.043 | 0.232 | 1.323 | Benef. | 2.073 | true | Venezuela | 0.035 | 0.239 | 1.365 | Benef. | 2.644 | true |
| | Egypt | 0.044 | 0.242 | 1.318 | Benef. | 2.606 | true | Swaziland | 0.035 | 0.249 | 1.365 | Benef. | 2.512 | true |
| 15 non-OECD countries with the lowest percentage of highly skilled 15+ expatriates in OECD countries | Guyana | 0.83 | 0.076 | -0.948 | Benef. | 2.069 | false | Guyana | 0.769 | 0.076 | -0.960 | Benef. | 2.069 | false |
| | Jamaica | 0.819 | 0.092 | -0.951 | Benef. | 2.012 | false | Jamaica | 0.726 | 0.092 | -0.959 | Benef. | 2.012 | false |
| | Haiti | 0.785 | 0.087 | -0.958 | Benef. | 1.854 | false | Guinea-Bissau | 0.703 | 0.224 | -0.955 | Benef. | 0.707 | false |
| | Trinidad and Tobago | 0.76 | 0.194 | -0.961 | Benef. | 2.331 | false | Haiti | 0.68 | 0.087 | -0.947 | Benef. | 1.854 | false |
| | Fiji | 0.619 | 0.227 | -0.910 | Benef. | 2.020 | false | Trinidad and Tobago | 0.661 | 0.194 | -0.939 | Benef. | 2.331 | false |
| | Angola | 0.537 | 0.247 | -0.809 | Benef. | 0.839 | false | Mozambique | 0.523 | 0.233 | -0.785 | Benef. | 0.878 | false |
| | Cyprus | 0.533 | 0.243 | -0.802 | Benef. | | | Mauritius | 0.501 | 0.247 | -0.743 | Benef. | 1.407 | false |
| | Mauritius | 0.532 | 0.247 | -0.801 | Benef. | 1.407 | false | Barbados | 0.471 | 0.247 | -0.676 | Benef. | 2.032 | false |
| | Mozambique | 0.471 | 0.233 | -0.676 | Benef. | 0.878 | false | Fiji | 0.429 | 0.227 | -0.564 | Benef. | 2.020 | false |
| | Ghana | 0.451 | 0.249 | -0.625 | Benef. | 2.065 | false | Gambia | 0.423 | 0.202 | -0.546 | Benef. | 1.008 | false |
| | United Rep. Of Tanzania | 0.417 | 0.244 | -0.527 | Benef. | 2.342 | false | Congo | 0.337 | 0.201 | -0.236 | Benef. | 1.917 | false |
| | Uganda | 0.364 | 0.247 | -0.344 | Benef. | 2.148 | false | Sierra Leone | 0.324 | 0.225 | -0.181 | Benef. | 2.309 | true |
| | Kenya | 0.359 | 0.249 | -0.325 | Benef. | 2.093 | true | Ghana | 0.312 | 0.249 | -0.128 | Benef. | 2.065 | true |
| | Burundi | 0.343 | 0.250 | -0.261 | Benef. | 2.335 | false | Kenya | 0.278 | 0.249 | 0.032 | Benef. | 2.093 | true |
| | Sierra Leone | 0.333 | 0.225 | -0.219 | Benef. | 2.309 | true | Cyprus | 0.26 | 0.243 | 0.121 | Benef. | | |

## 4. Tests using Stark's and al, model

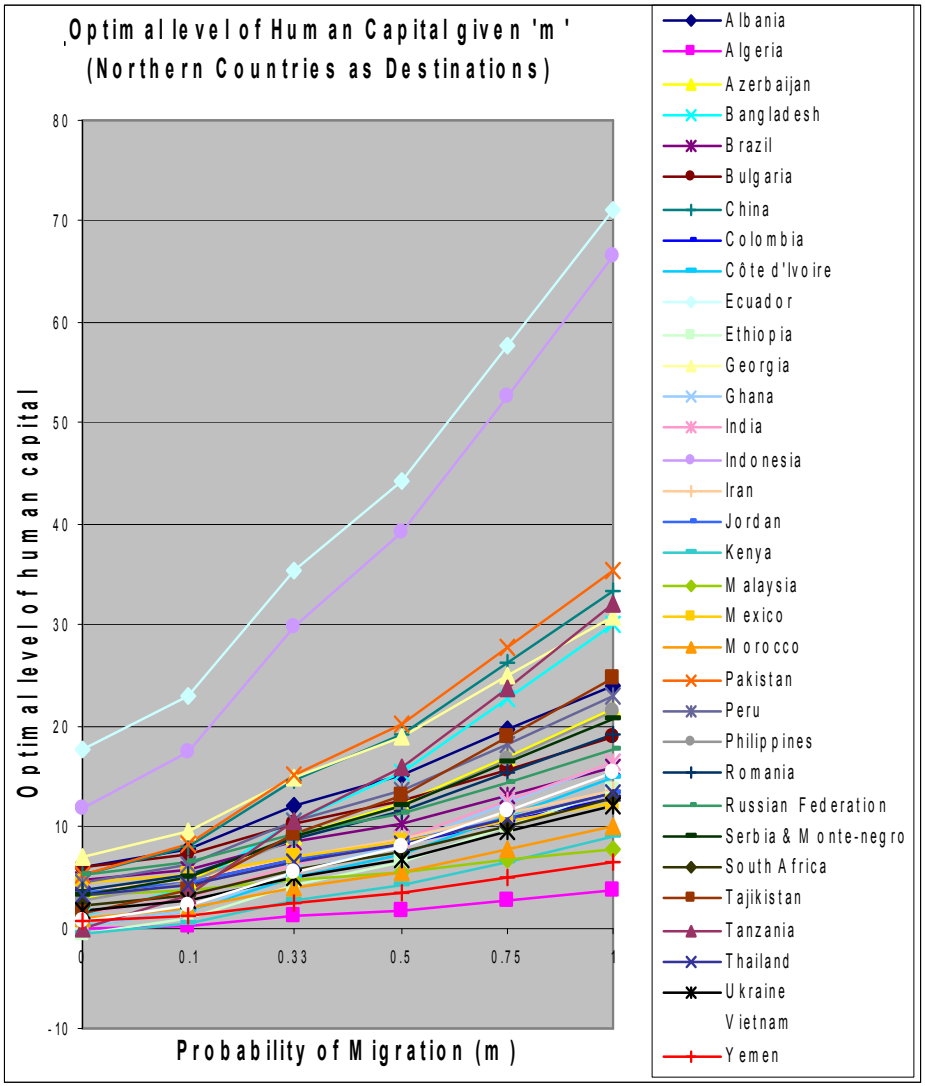
The main task here is to test the relevance of Stark's & al model through mainly the basic decision rule (equation 6 in the paper) that is $\tilde{g}^{S*} = \frac{m(\beta^D - \beta^S) + \beta^S}{k} - 1$. The variables $\beta^D$ and $\beta^S$ are labor productivities considering the USA as a reference country (International Labor Organization, 2006) and k is relative education expenditures (Public spending on education as % of GDP) over the educational expenditures of the USA (World Bank Data, 2006). The variable $\tilde{g}^{S*}$ is the level of human capital calculated using Stark's et al. model; KEI and KEIEducation are respectively the knowledge economic index and the index of education as a component of the knowledge economic index.

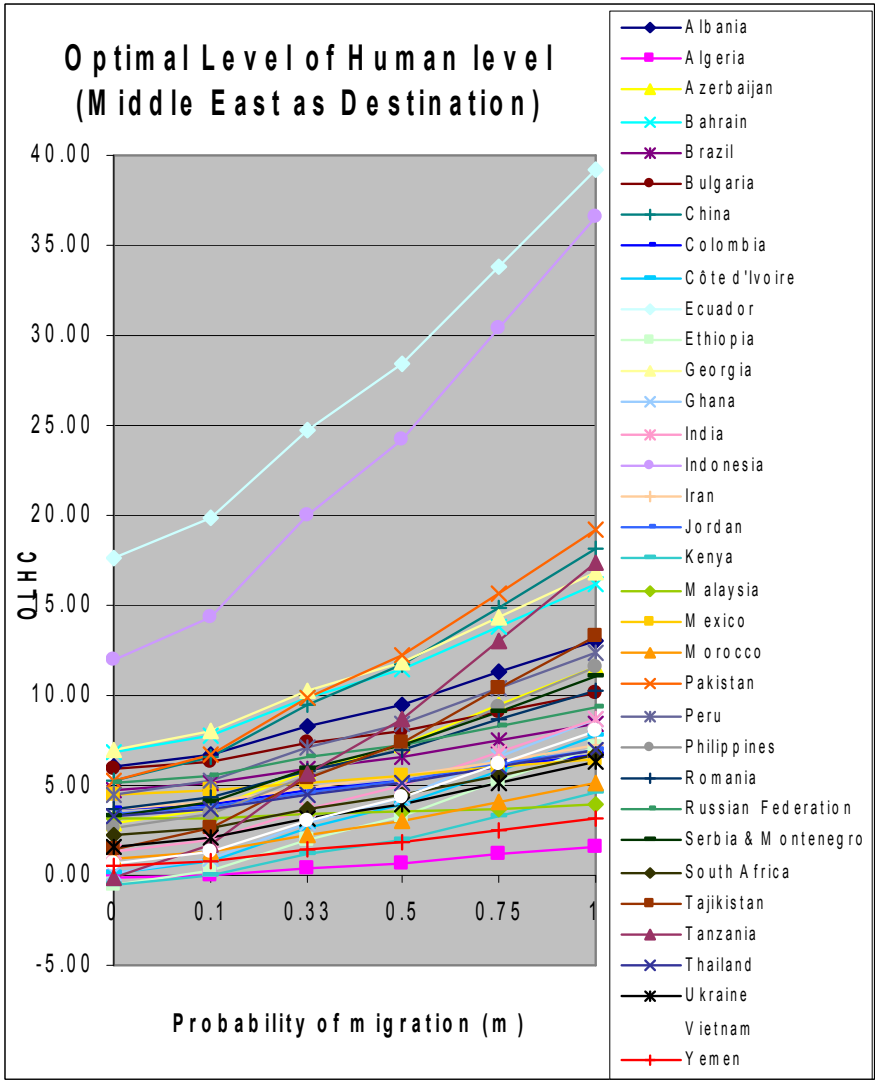
**Tests using Stark's and al, Model**

| Equations | $R^2$ | n |
|---|---|---|
| $KEI_{2003/04} = \underset{(4.862)}{0.417}\,\tilde{g}^{S*}$ | 0.507 | 24 |
| $KEI_{2003/04} = \underset{(4.652)}{0.353}\,\tilde{g}^{S*}$ | 0.485 | 24 |
| $KEIEducation_{2003/04} = \underset{(4.983)}{0.436}\,\tilde{g}^{S*}$ | 0.519 | 24 |
| $KEIEducation_{2003/04} = \underset{(4.676)}{0.366}\,\tilde{g}^{S*}$ | 0.487 | 24 |
| $KEI_{2003/04} = \underset{(15.827)}{21.159}\,\beta^S$ | 0.916 | 24 |
| $KEI_{2003/04} = \underset{(10.628)}{4.743}\,\beta^D$ | 0.831 | 24 |

These results show that the labor productivity in both developed and developing economies are related to the exogenous index of human capital as it is represented by KEI. This latter is also positively correlated with the calculated level of human capital using Stark's decision rule (equation 6 in Stark's & al, 2005).

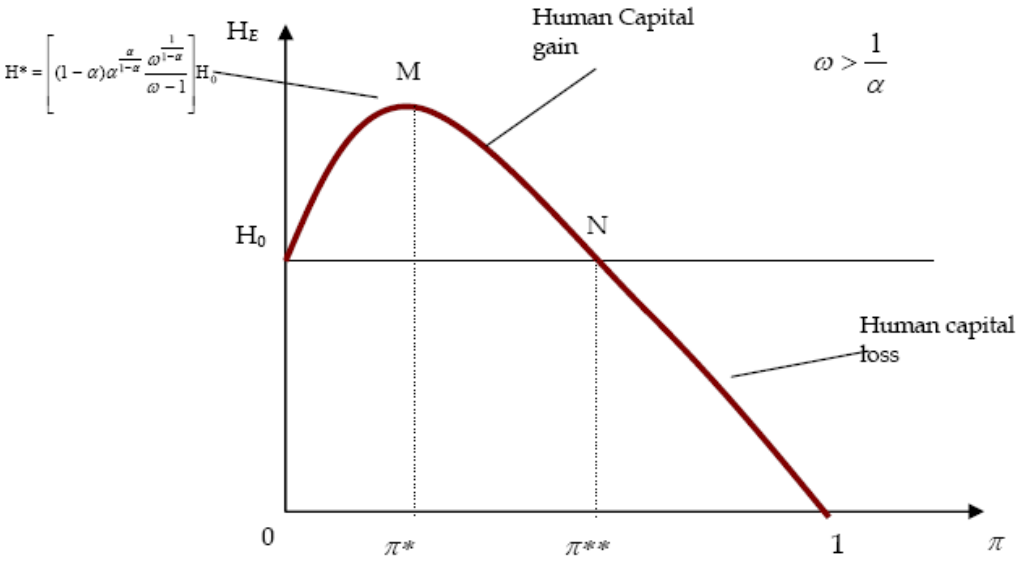
The following figures represent the optimal level of human capital ($\tilde{g}^{S*}$) given different probabilities of migration (m), when the countries of destination are, first, the northern countries and second, the Middle Eastern. The tables of estimation for those results, following Stark's et al. model, are in the appendix.


Optimal level of Human Capital given 'm'
(Northern Countries as Destinations)
Optimal level of human capital
80
70
60
50
40
30
20
10
0
-10
0
0.1
0.33
0.5
0.75
1
Probability of Migration (m)
Albania
Algeria
Azerbaijan
Bangladesh
Brazil
Bulgaria
China
Colombia
Côte d'Ivoire
Ecuador
Ethiopia
Georgia
Ghana
India
Indonesia
Iran
Jordan
Kenya
Malaysia
Mexico
Morocco
Pakistan
Peru
Philippines
Romania
Russian Federation
Serbia & Monte-negro
South Africa
Tajikistan
Tanzania
Thailand
Ukraine
Vietnam
Yemen


Optimal Level of Human level
(Middle East as Destination)
QLHC
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
0
0.1
0.33
0.5
0.75
1
Probability of migration (m)
Albania
Algeria
Azerbaijan
Bahrain
Brazil
Bulgaria
China
Colombia
Côte d'Ivoire
Ecuador
Ethiopia
Georgia
Ghana
India
Indonesia
Iran
Jordan
Kenya
Malaysia
Mexico
Morocco
Pakistan
Peru
Philippines
Romania
Russian Federation
Serbia & Montenegro
South Africa
Tajikistan
Tanzania
Thailand
Ukraine
Vietnam
Yemen

## 5. N. Duc Thanh model (Heterogeneous talents and optimal emigration, 2004)

The following figure reproduced from the paper by the author (page 9) shows how the consideration of heterogeneous skills lead to an overall human capital formation that varies with the levels of migration probabilities. The major conditions underlying this model are that relative wages in the destination and source countries are higher than one and that this wage ratio is higher than the inverse of the technical coefficient of the cost of education function ($1/\alpha<\omega$). It shows also that when emigration is absent, the level Ho can be achieved. There are gains (brain gains) realized after reaching the level of migration $\pi^*$ that maximizes the level of human capital. Above this latter probability value, losses start to occur in the source country. An equivalent level equal to Ho is attained (N) when emigration attains the value $\pi^{**}$. The level of capital is then definitely decreasing (brain drain) between $\pi^{**}$ and 1.




**Source**: Duc Thanh, Nguyen. Heterogeneous Talent and Optimal Emigration- A contribution to the new economics of the brain drain, Sept. 2004, p: 9.

In order to visualize the meaningfulness of this model, different simulations using different values for **α**, **ω** and **π** are first considered. Based on the empirical data available mainly for **ω** and the migration rate, $\mathbf{H/H_0}$ is calculated for each developing country that is in the sample. The last step is to test for the existence of a relationship that could validate the N. Duc Thanh model. This is realized in two stages that are based on the introduction of the index of tertiary education enrollment as included in the knowledge economic index, **Keied**, (World Bank Institute, 2006), the investment per capita in higher education measured by the expenditure per student, tertiary as % of GDP per capita, **c**, (World Bank Database) and the ratio of country GDP, **ω**, which is equal to the ratio of GDP of the country of destination on the GDP of the source country (World Bank Database, 2005). This ratio is larger than 1 as required in the model. Stage 1 gives the results of the regression analyzes of the logarithm of **Keied** as a function of the logarithm of **c** and the logarithm of **ω**, while stage 2 represents the regressions of $\mathbf{H/H_0}$ on the logarithm of **Keied**. The results of both stages are presented in the following tables. The estimated equations for five destinations that are USA, EU, Canada, Australia and average are statistically are given by the regressions given below.

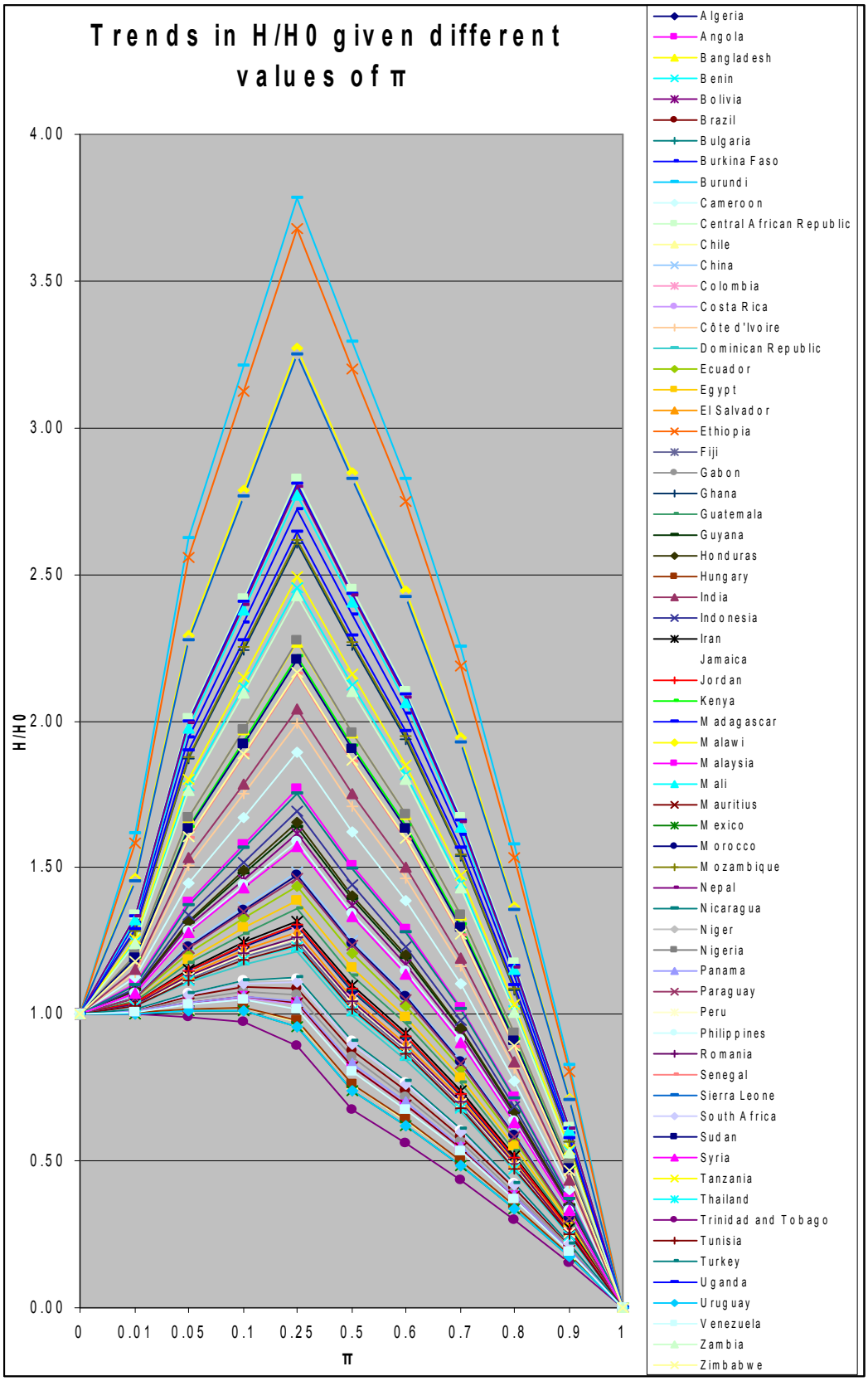
| *Destination Country* | *Regressions* | *DF* | *R²* |
|---|---|---|---|
| *Developing countries with Wage of USA* | $\ln(Keied_{2003/04}) = \underset{(12.29)}{3.64} - \underset{(-3.81)}{0.35}\ln(c) - \underset{(-4.53)}{0.34}\ln(\omega)$ | 24 | 0.80 |
| *Developing countries with Wage of Canada* | $\ln(Keied_{2003/04}) = \underset{(11.68)}{3.48} - \underset{(-3.76)}{0.35}\ln(c) - \underset{(-4.49)}{0.33}\ln(\omega)$ | 24 | 0.80 |
| *Developing countries with Wage of Australia* | $\ln(Keied_{2003/04}) = \underset{(11.53)}{3.45} - \underset{(-3.76)}{0.35}\ln(c) - \underset{(-4.49)}{0.33}\ln(\omega)$ | 24 | 0.80 |
| *Developing countries with Wage of EU* | $\ln(Keied_{2003/04}) = \underset{(11.49)}{3.43} - \underset{(-3.60)}{0.34}\ln(c) - \underset{(-4.62)}{0.35}\ln(\omega)$ | 24 | 0.81 |
| *Developing countries with wage of Ave rage Destination Country* | $\ln(Keied_{2003/04}) = \underset{(11.78)}{3.51} - \underset{(-3.76)}{0.35}\ln(c) - \underset{(-4.49)}{0.34}\ln(\omega)$ | 24 | 0.80 |

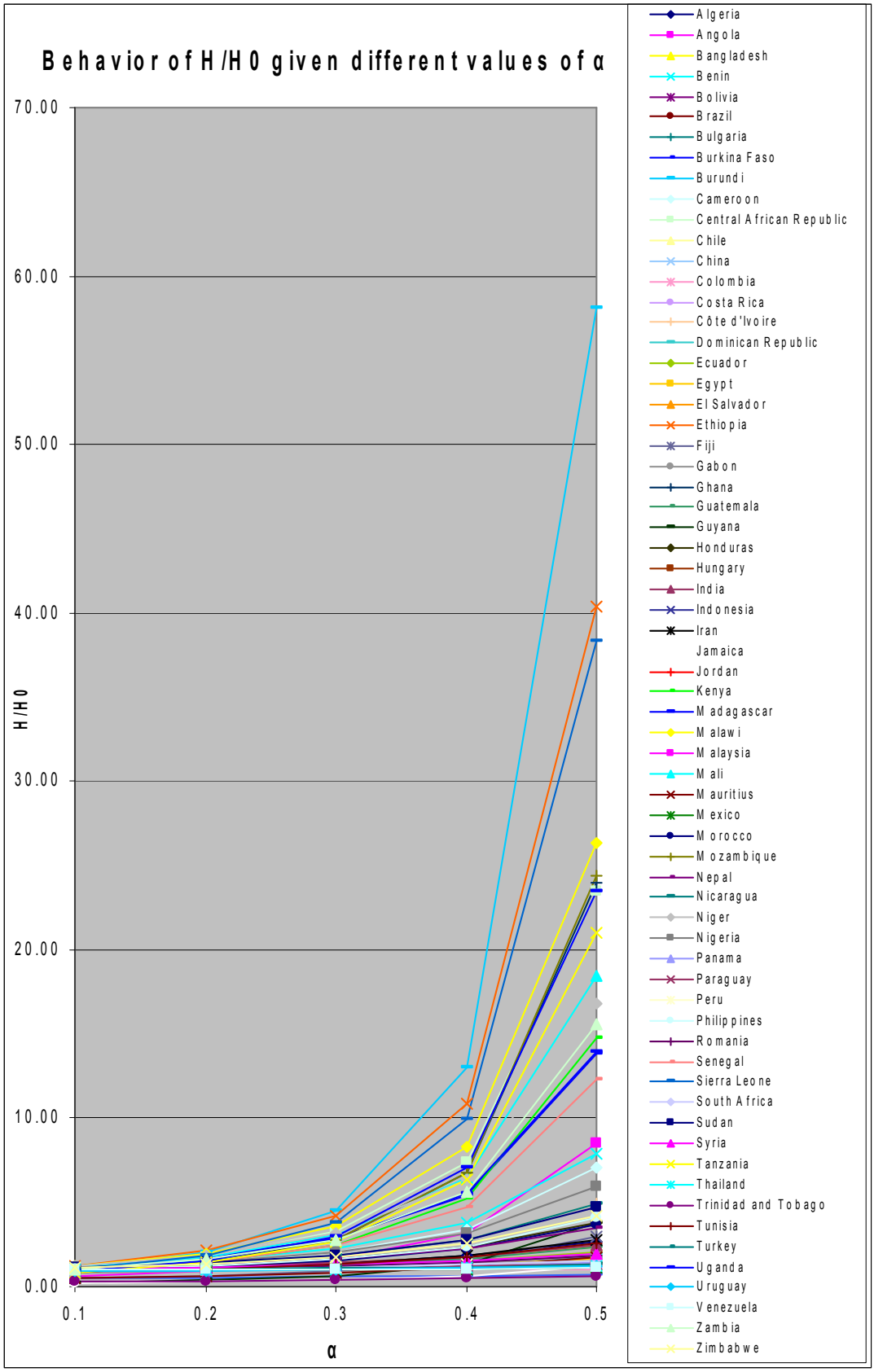
The above results show how the subcomponent of KEI as a measure of human capital is explained by expenditures on education (measured as a share of GDP that is less than one) and the relative wage variable that is higher than one. It is worth to observe that the coefficient on ln (**c**) is positive while the one on ln (**ω**) is negative. This leads to considering that human capital formation in relation to skilled labor (tertiary education) is related to the cost of human capital formation and to the relative wages of destination countries relative to the source of emigration.

**Test using N. Duc Thanh model (selection of the best regressions)**

| **Equations** | **α** | **R²** | **n** |
|---|---|---|---|
| $\frac{H}{H_0} = \underset{(5.723)}{0.279}\,Keied_{2003/04}$ | 0.3 | 0.373 | 56 |
| $\frac{H}{H_0} = \underset{(6.249)}{0.268}\,Keied_{2003/04}$ | 0.28 | 0.415 | 56 |
| $\frac{H}{H_0} = \underset{(6.536)}{0.487}\ln(Keied_{2003/04})$ | 0.1 | 0.437 | 56 |
| $\frac{H}{H_0} = \underset{(4.851)}{0.505}\ln(Keied_{2003/04})$ | 0.2 | 0.3 | 56 |
| $\frac{H}{H_0} = \underset{(2.968)}{0.503}\ln(Keied_{2003/04})$ | 0.3 | 0.14 | 56 |
| $\frac{H}{H_0} = \underset{(3.352)}{0.507}\ln(Keied_{2003/04})$ | 0.28 | 0.17 | 56 |

Based on the above regressions (other regressions are in the appendix), it appears that the technical coefficient is around 0.28 and 0.3. With this remark an average scenario can be established for the set of sending countries included in the sample with the average destination. The following figure introduces the pattern of the human capital for every sending country.


Trends in H/H0 given different values of π
H/H0
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0
0.01
0.05
0.1
0.25
0.5
0.6
0.7
0.8
0.9
1
π
Algeria
Angola
Bangladesh
Benin
Bolivia
Brazil
Bulgaria
Burkina Faso
Burundi
Cameroon
Central African Republic
Chile
China
Colombia
Costa Rica
Côte d'Ivoire
Dominican Republic
Ecuador
Egypt
El Salvador
Ethiopia
Fiji
Gabon
Ghana
Guatemala
Guyana
Honduras
Hungary
India
Indonesia
Iran
Jamaica
Jordan
Kenya
Madagascar
Malawi
Malaysia
Mali
Mauritius
Mexico
Morocco
Mozambique
Nepal
Nicaragua
Niger
Nigeria
Panama
Paraguay
Peru
Philippines
Romania
Senegal
Sierra Leone
South Africa
Sudan
Syria
Tanzania
Thailand
Trinidad and Tobago
Tunisia
Turkey
Uganda
Uruguay
Venezuela
Zambia
Zimbabwe


Behavior of H/H0 given different values of α
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
H/H0
0.1
0.2
0.3
0.4
0.5
α
Algeria
Angola
Bangladesh
Benin
Bolivia
Brazil
Bulgaria
Burkina Faso
Burundi
Cameroon
Central African Republic
Chile
China
Colombia
Costa Rica
Côte d'Ivoire
Dominican Republic
Ecuador
Egypt
El Salvador
Ethiopia
Fiji
Gabon
Ghana
Guatemala
Guyana
Honduras
Hungary
India
Indonesia
Iran
Jamaica
Jordan
Kenya
Madagascar
Malawi
Malaysia
Mali
Mauritius
Mexico
Morocco
Mozambique
Nepal
Nicaragua
Niger
Nigeria
Panama
Paraguay
Peru
Philippines
Romania
Senegal
Sierra Leone
South Africa
Sudan
Syria
Tanzania
Thailand
Trinidad and Tobago
Tunisia
Turkey
Uganda
Uruguay
Venezuela
Zambia
Zimbabwe

These preliminary empirical results lead to considering the theoretical models suggested by Beine & al, Stark & al (2005) and Nguyen (2004). The latter models are based on the abilities and skills as the building block to the overall economic frameworks suggested. The second model has suggested a special specification that is based on the expenditures on education and heterogeneous talents.

**6. Sources of overestimation as in M.Schiff (2005)**

The sources of overestimation of brain gains exist as they originates from brain waste, negative brain gain, risk aversion behavior and general equilibrium effects. The brain waste occurs when the skilled emigrant occupies positions that require lower levels of skills implying that the person is undervalued both on wage and knowledge accumulation. The negative brain drain takes place when receiving countries prefer to employ lower skills or unskilled emigrants implying that the positive expected effects on education in the source countries become limited or negative. In case, the above models are considered to account for aversion to risks, the human capital accumulation of knowledge and the brain gains are reduced by at least by a fraction of the variance of gains in case of constant absolute aversion. Expenditures on education is the other component that can lower the overall gains because of the difficulties under the limited and same level of resources to increase the budget for education without affecting the other sectors.

## IV. Discussion of Results & Policy Implications

The major results attained in this research relate to the determinants and impacts of skilled labor migration. The determinants appear to be those that have been largely described in the previous sources and documents. They all relate to the large differential in income, in living conditions, in access and use of knowledge, in freedom and transparency besides the availability of decent jobs and occupations. The implications are those that relate to a loss of flows of human skills but with lesser negative impacts on developing economies. These economies can still have access to remittances, foreign direct investments and other means that enhance the possibilities offered. Investment in education appears to exhibit promising positive effects if accompanied with larger access to local, national and international sources of knowledge. These processes are likely to generate new development opportunities that can be accelerated by the attraction of foreign investments, relocation of firms, promotion of new enterprises and then the expansion of the engine of growth. All these factors favor the attractiveness of the economy and accelerate the partial or permanent return of skilled labor. But, they are medium and long term issues that should be raised in relation to the intensification of emigration from South to North. The factors of intensification can be related to the larger negative impacts of climatic changes with their direct effects on economies that are mainly based on agriculture and natural resources with limited focus on industries and services. The impacts of such dependencies on natural resources can enlarge income differences and living conditions between developed and developing countries if the current trends were maintained. These enlarged differences can be major sources for the intensification of emigration to developed countries, starting with skilled labor. Bu, as it can be seen from the results above, there are short run types of niches that can create new conditions in the developing world. Developing economies still have possibilities of engaging in a new dynamics that can increase the benefits from migration if new measures are attempted and reforms accelerated in different areas that include mainly educational reforms, promotion of knowledge and the lack of generalization of access to both knowledge and education.

# Conclusion

It is expected that globalization and world development to be likely increasing the rates of emigration from developing (South) to developed economies (North) unless growth and prosperity take place in most countries of the South. Even under the optimistic scenario of further growth and development in the South, individuals and groups enjoy the freedom of mobility if they have larger opportunities to choose from.

Within this context, skilled labor migration takes place and generates consequently higher benefits for individuals, groups and communities but also to both the source and destination countries. The benefits to the sending countries are monetary but also non monetary as they are expressed under direct and indirect benefits of emigration. Remittances are not the only benefits but knowledge and experience besides the direct impacts on the enhancement of education and research in the source country are major sources of gains. This type of emigration was considered to be a brain drain but the new economics on migration has identified that is a brain gain.

The two objectives of this paper were to reveal the determinants of skilled labor migration and to assess empirically the impacts of this migration from the available and accessible data.

The existing large literature on different dimensions of skilled labor migration has helped set a selection of the theoretical grounds needed for the empirical assessments. Some previous studies have also helped in the identification of the determinants. For the impact assessment, the models selected are within the generation of new economics of skilled labor migration. The models of Beine &al, Stark & al and Nguyen besides that of M. Schiff have been explicit both theoretically and possible databases identified for the empirical estimations.

The results obtained have confirmed the relevance of series of variables that are related to economic, social and political dimension of the economies. Much of the time, these variables are represented as differences between the situation in developed and developing economies. Some of the recently established indices such as those related to knowledge, corruption perception and openness of the economy have been useful in the estimation of the determinants of skilled labor migration.

Concerning the impacts, each of the above models in explaining the existence of brain gains throughout the sample of developing economies is retained. This brain gain is mainly represented as a stock of human capital that can vary depending on the emigration rate. It is also empirically related to the situation prevailing in the source economy. The newly established indices and mainly the knowledge economic index and some of its components have been instrumental in testing the relevance of the Stark & al and Nguyen models.

The policy discussion implied by the above results includes both the promotion of development in each source country with emphasis on education, knowledge and freedom of access to these domains besides to emigration as a choice.

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World Bank database

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# APPENDIX

**Table 1: Estimates of the emigration rate (EM1) using GDP, HDI, KEI, CPI, EFI and other variables**

| Variables | Estimators | $R^2$ | Significance | Country group |
|---|---|---|---|---|
| Dependent :EM1<br>Independent :<br>$GDP_{2003}$, $HDI_{2003}$ | $EM_1 = e^{1.021 GDP_{2003}} e^{\frac{1.142}{HDI_{2003}}}$ | 0.853 | All coefficients are significant with a probability of 99%<br>The model is validated with a probability of 99% | All countries (90 countries) |
| | $EM_1 = e^{1.762 GDP_{2003}} e^{\frac{1.051}{HDI_{2003}}}$ | 0.869 | All coefficients are significant with a probability of 99%<br>The model is validated with a probability of 99% | Developing countries (68 countries) |
| Dependent :EM1<br>Independent :<br>$KEI_{2003}$, $HDI_{2003}$ | $EM_1 = e^{\frac{0.895}{KEI_{2003}}} e^{\frac{6.772}{HDI_{2003}}}$ | 0.827 | The coefficients are not significant<br>The model is validated with a probability of 99% | Developed countries (22 countries) |
| Dependent :EM1<br>Independent :<br>$CPI_{2004}$, $GDP_{2003}$ | $EM_1 = e^{\frac{5.428}{CPI_{2004}}} e^{1.358 GDP_{2003}}$ | 0.813 | All coefficients are significant with a probability of 99%<br>The model is validated with a probability of 99% | All countries (90 countries) |
| | $EM_1 = e^{\frac{1.252}{CPI_{2004}}} e^{1.921 GDP_{2003}}$ | 0.816 | The coefficient of $CPI_{2004}$ is significant with a probability of 95% and the coefficient of $GDP_{2003}$ is significant with a probability of 99%.<br>The model is validated with a probability of 99% | Developed countries (22 countries) |
| | $EM_1 = e^{\frac{5.268}{CPI_{2004}}} e^{1.566 GDP_{2003}}$ | 0.815 | All coefficients are significant with a probability of 99%<br>The model is validated with a probability of 99% | Developing countries (68 countries) |
| Dependent :EM1<br>Independent :<br>$KEI_{2003}$, $GDP_{2003}$,<br>$EFI_{2003}$ | $EM_1 = e^{\frac{0.975}{KEI_{2003}}} e^{0.843 GDP_{2003}} e^{0.481 EFI_{2003}}$ | 0.827 | The coefficient of $KEI_{2003}$ and $GDP_{2003}$ are significant with a probability of 95% and the coefficient of $EFI_{2003}$ is significant with a probability of 99%.<br>The model is validated with a probability of 99% | All countries (80 countries) |
| | $EM_1 = e^{\frac{50.021}{KEI_{2003}}} e^{-1.348 GDP_{2003}} e^{-1.507 EFI_{2003}}$ | 0.859 | The coefficient of $KEI_{2003}$ and $EFI_{2003}$ are significant with a probability of 95% and the coefficient of $GDP_{2003}$ is not significant.<br>The model is validated with a probability of 99% | Developed countries (22 countries) |

| | | | | |
|---|---|---|---|---|
| Dependent :$EM_4$<br>Independent :<br>$EFI_{2003}$, $HDI_{2003}$, $KEI_{2003}$ | $EM_4 = -1.757 EFI_{2003} + 14.198 HDI_{2003} - 0.063 KEI_{2003}^2$ | 0.485 | The coefficients of $EFI_{2003}$ and HDI are significant with a probability of 99% and the coefficient of $KEI_{2003}^2$ is significant with probability of 90%.<br>The model is validated with a probability of 99% | All countries (89 countries) |
| | $EM_4 = -7.524 EFI_{2003} + 45.122 HDI_{2003} - 0.309 KEI_{2003}^2$ | 0.711 | The coefficients of $EFI_{2003}$ and $KEI_{2003}^2$ are significant with a probability of 95% and the coefficient of $HDI_{2003}$ is significant with probability of 99%.<br>The model is validated with a probability of 99% | Developed countries (24 countries) |
| Dependent :$EM_4$<br>Independent :<br>$HDI_{2003}$, $GDP_{2003}$, $EFI_{2003}$ | $EM_4 = 16.213 HDI_{2003}^2 - 11.379 GDP_{2003}^2 - 0.162 EFI_{2003}^2$ | 0.429 | The coefficients of $EFI_{2003}^2$ and $GDP_{2003}^2$ are significant with a probability of 90% and the coefficient of $HDI_{2003}^2$ is significant with probability of 99%.<br>The model is validated with a probability of 99% | All countries (103 countries) |
| | $EM_4 = 16.314 HDI_{2003}^2 - 10.193 GDP_{2003}^2 - 0.552 EFI_{2003}^2$ | 0.635 | The coefficients are not significant.<br>The model is validated with a probability of 99% | Developed countries (24 countries) |
| | $EM_4 = 12.715 HDI_{2003}^2 - 2.868 GDP_{2003}^2 - 0.152 EFI_{2003}^2$ | 0.397 | The coefficients of $EFI_{2003}^2$ and $GDP_{2003}^2$ are not significant and the coefficient of $HDI_{2003}^2$ is significant with probability of 95%.<br>The model is validated with a probability of 99% | Developing countries (79 countries) |
| Dependent :$EM_4$<br>Independent :<br>$KEI_{2003}$, $CPI_{2004}$, $HDI_{2003}$, $EFI_{2003}$ | $EM_4 = -0.109 KEI_{2003}^2 + 2.31 \ln(CPI_{2004}) + 10.735 HDI_{2003}^2 - 0.307 EFI_{2003}^2$ | 0.491 | The coefficients of $EFI_{2003}^2$ and $KEI_{2003}^2$ are significant with a probability of 95%, the coefficient of $HDI_{2003}^2$ is significant with probability of 99% and the coefficient of $\ln(CPI_{2004})$ is significant with a probability of 90%.<br>The model is validated with a probability of 99% | All countries (89 countries) |
| | $EM_4 = -0.383 KEI_{2003}^2 + 3.164 \ln(CPI_{2004}) + 36.833 HDI_{2003}^2 - 1.604 EFI_{2003}^2$ | 0.71 | The coefficient of $KEI_{2003}^2$ is significant with a probability of 95%, the coefficients of $HDI_{2003}^2$ and $EFI_{2003}^2$ are significant with probability of 90% and the coefficient of $\ln(CPI_{2004})$ is not significant.<br>The model is validated with a probability of 99% | Developed countries (24 countries) |
| | $EM_4 = -0.012 KEI_{2003}^2 + 1.834 \ln(CPI_{2004}) + 7.209 HDI_{2003}^2 - 0.228 EFI_{2003}^2$ | 0.435 | The coefficients of $HDI_{2003}^2$ and $EFI_{2003}^2$ are significant with probability of 90% and the coefficients of $KEI_{2003}^2$ and $\ln(CPI_{2004})$ are not significant.<br>The model is validated with a probability of 99% | Developing countries (65 countries) |

**Table 2: Evaluation of the Beneficial Brain Drain Effect (Cohen and Soto, 2001) from the first 15 non OECD countries both with lowest and highest Values.**

| Developing country | HDI 1995 | HDI 2000 | KEI 1995 | ASE Exp. | GDP gr. 2000 | m (CS 2001) | humi 2000 | humi 1990 | Hi 1990 | Hi 2000 | Hi transf | m' | PSI | PSI (m=0) | Hi0 | Hi0 (1-Hi0) | Deriv-Psi | Benef BD | Net gr. Effc | mi= EM5 | Hi(1-Hi)/ (1-mi) | Benef. M Inc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | 0.75 | 0.78 | 4.62 | 4.84 | 4.50 | 0.02 | 0.43 | 0.27 | 0.28 | 0.44 | 0.19 | 1.56 | 0.17 | 0.17 | 0.41 | 0.24 | 1.46 | Benef. | 2.04 | 0.44 | 0.44 | true |
| Myanmar | | | | | | 0.02 | | | | | | 1.56 | 0.42 | 0.41 | 0.41 | 0.24 | 1.46 | Benef. | | 0.19 | | |
| Indonesia | 0.66 | 0.68 | 3.23 | 0.65 | 4.77 | 0.02 | 0.46 | 0.17 | 0.17 | 0.47 | 0.31 | 1.57 | 0.12 | 0.12 | 0.27 | 0.20 | 1.45 | Benef. | 2.15 | 0.21 | 0.31 | true |
| Thailand | 0.75 | | 4.96 | 3.45 | 4.31 | 0.02 | 0.45 | 0.24 | 0.25 | 0.45 | 0.23 | 1.57 | 0.14 | 0.14 | 0.36 | 0.23 | 1.45 | Benef. | 2.08 | 0.59 | 0.60 | true |
| Bangladesh | 0.45 | 0.51 | 0.82 | 1.71 | 5.94 | 0.02 | 0.36 | 0.17 | 0.17 | 0.37 | 0.22 | 1.57 | 0.25 | 0.24 | 0.39 | 0.24 | 1.44 | Benef. | 1.74 | 0.35 | 0.36 | true |
| Paraguay | 0.74 | 0.75 | 3.17 | 3.47 | -0.30 | 0.02 | 0.46 | 0.25 | 0.25 | 0.47 | 0.24 | 1.57 | 0.15 | 0.14 | 0.37 | 0.23 | 1.44 | Benef. | 2.12 | 0.61 | 0.64 | true |
| Nepal | 0.47 | 0.50 | 2.00 | 2.07 | 6.45 | 0.02 | 0.47 | 0.14 | 0.14 | 0.49 | 0.36 | 1.57 | 0.25 | 0.24 | 0.37 | 0.23 | 1.44 | Benef. | 2.19 | 0.18 | 0.31 | true |
| India | 0.55 | 0.58 | 2.79 | 3.35 | 3.92 | 0.03 | 0.61 | 0.15 | 0.16 | 0.62 | 0.48 | 1.58 | 0.24 | 0.23 | 0.37 | 0.23 | 1.39 | Benef. | 2.66 | 0.28 | 0.33 | true |
| Bolivia | 0.64 | 0.67 | 3.78 | 5.53 | 2.37 | 0.03 | 0.51 | 0.29 | 0.30 | 0.52 | 0.25 | 1.58 | 0.24 | 0.23 | 0.50 | 0.25 | 1.39 | Benef. | 2.33 | 1.44 | -0.57 | true |
| China | 0.68 | | 2.85 | 2.03 | 7.94 | 0.03 | 0.48 | 0.23 | 0.23 | 0.49 | 0.28 | 1.59 | 0.15 | 0.14 | 0.34 | 0.23 | 1.38 | Benef. | 2.22 | 0.20 | 0.31 | true |
| Jordan | 0.71 | 0.74 | 4.04 | 5.61 | 3.88 | 0.03 | 0.56 | 0.27 | 0.29 | 0.57 | 0.32 | 1.59 | 0.21 | 0.20 | 0.46 | 0.25 | 1.38 | Benef. | 2.50 | 2.05 | -0.23 | true |
| Venezuela | 0.77 | 0.77 | 4.78 | 5.01 | 3.21 | 0.03 | 0.60 | 0.25 | 0.26 | 0.61 | 0.37 | 1.59 | 0.17 | 0.16 | 0.39 | 0.24 | 1.38 | Benef. | 2.64 | 1.41 | -0.58 | true |
| Costa Rica | 0.81 | 0.83 | 5.88 | 5.07 | 1.66 | 0.04 | 0.45 | 0.38 | 0.40 | 0.47 | 0.11 | 1.60 | 0.16 | 0.14 | 0.50 | 0.25 | 1.34 | Benef. | 2.10 | 2.80 | -0.14 | true |
| Syria | 0.67 | 0.69 | 2.36 | 2.60 | 2.50 | 0.04 | 0.44 | 0.22 | 0.23 | 0.46 | 0.25 | 1.60 | 0.17 | 0.15 | 0.36 | 0.23 | 1.32 | Benef. | 2.07 | 1.30 | -0.84 | true |
| Egypt | 0.61 | | 3.82 | 4.41 | 5.12 | 0.04 | 0.59 | 0.20 | 0.21 | 0.60 | 0.41 | 1.60 | 0.24 | 0.22 | 0.41 | 0.24 | 1.32 | Benef. | 2.61 | 0.72 | 0.85 | true |
| | | | | | | | | | | | | | | | | | | | | | | |
| Guyana | 0.69 | 0.71 | | 3.30 | -0.70 | 0.83 | 0.44 | 0.32 | 0.84 | 0.88 | 0.12 | 1.37 | 0.12 | 0.16 | 0.92 | 0.08 | -0.95 | Benef. | 2.07 | 36.48 | 0.00 | false |
| Jamaica | 0.72 | 0.73 | 5.09 | 6.84 | 0.79 | 0.82 | 0.43 | 0.32 | 0.76 | 0.83 | 0.15 | 1.38 | 0.17 | 0.22 | 0.90 | 0.09 | -0.95 | Benef. | 2.01 | 30.60 | 0.00 | false |
| Haiti | 0.45 | | 0.86 | 1.59 | 1.12 | 0.79 | 0.39 | 0.38 | 0.74 | 0.80 | 0.13 | 1.41 | 0.20 | 0.24 | 0.90 | 0.09 | -0.96 | Benef. | 1.85 | 8.79 | -0.02 | false |
| Trinidad and Tobago | 0.79 | 0.80 | | 3.44 | 4.78 | 0.76 | 0.51 | 0.33 | 0.69 | 0.83 | 0.21 | 1.43 | 0.09 | 0.12 | 0.74 | 0.19 | -0.96 | Benef. | 2.33 | 22.13 | -0.01 | false |
| Fiji | 0.74 | | | 4.86 | -7.99 | 0.62 | 0.43 | 0.28 | 0.54 | 0.67 | 0.18 | 1.57 | 0.18 | 0.17 | 0.65 | 0.23 | -0.91 | Benef. | 2.02 | 17.81 | -0.01 | false |
| Angola | | | 0.32 | 4.40 | 2.12 | 0.54 | 0.17 | 0.05 | 0.05 | 0.23 | 0.19 | 1.64 | 0.53 | 0.51 | 0.55 | 0.25 | -0.81 | Benef. | 0.84 | 2.85 | -0.10 | false |
| Cyprus | | | | | | 0.53 | | | | | | 1.64 | 0.44 | 0.41 | 0.41 | 0.24 | -0.80 | Benef. | | 19.28 | | |
| Mauritius | 0.75 | 0.78 | 4.97 | 3.25 | 8.02 | 0.53 | 0.29 | 0.16 | 0.35 | 0.48 | 0.16 | 1.64 | 0.16 | 0.13 | 0.45 | 0.25 | -0.80 | Benef. | 1.41 | 9.33 | -0.03 | false |
| Mozambique | 0.33 | 0.36 | 0.52 | 3.69 | 1.60 | 0.47 | 0.18 | 0.03 | 0.03 | 0.28 | 0.25 | 1.69 | 0.38 | 0.34 | 0.37 | 0.23 | -0.68 | Benef. | 0.88 | 0.82 | 1.16 | false |
| Ghana | 0.53 | 0.56 | 1.60 | 4.43 | 3.70 | 0.45 | 0.44 | 0.16 | 0.24 | 0.60 | 0.38 | 1.70 | 0.30 | 0.26 | 0.47 | 0.25 | -0.63 | Benef. | 2.06 | 1.47 | -0.51 | false |
| Tanzania | 0.42 | 0.42 | 1.04 | 3.40 | 5.07 | 0.42 | 0.51 | 0.13 | 0.15 | 0.55 | 0.41 | 1.72 | 0.34 | 0.29 | 0.42 | 0.24 | -0.53 | Benef. | 2.34 | 0.37 | 0.40 | false |
| Uganda | 0.41 | 0.47 | 1.18 | 2.19 | 3.50 | 0.36 | 0.46 | 0.12 | 0.19 | 0.57 | 0.40 | 1.74 | 0.32 | 0.27 | 0.44 | 0.25 | -0.34 | Benef. | 2.15 | 0.68 | 0.75 | false |
| Kenya | 0.52 | 0.50 | 1.79 | 6.12 | -0.24 | 0.36 | 0.45 | 0.12 | 0.20 | 0.57 | 0.39 | 1.74 | 0.35 | 0.30 | 0.47 | 0.25 | -0.32 | Benef. | 2.09 | 1.13 | -1.95 | true |
| Burundi | 0.32 | | | 3.07 | 0.30 | 0.34 | 0.51 | 0.19 | 0.20 | 0.53 | 0.35 | 1.75 | 0.38 | 0.33 | 0.51 | 0.25 | -0.26 | Benef. | 2.33 | 0.28 | 0.35 | false |
| Sierra Leone | | | 1.09 | 1.07 | 6.96 | 0.33 | 0.50 | 0.18 | 0.25 | 0.68 | 0.46 | 1.75 | 0.49 | 0.44 | 0.66 | 0.22 | -0.22 | Benef. | 2.31 | 1.42 | -0.51 | true |

**Table 3: Evaluation of the Beneficial Brain Drain Effect (Barro and Lee, 2000) from the first 15 non OECD countries both with lowest and highest Values.**

| Developing country | HDI 1995 | HDI 2000 | KEI 1995 | ASE Exp. | GDP gr. 2000 | m (BL 2000) | humi 2000 | humi 1990 | Hi 1990 | Hi 2000 | Hi transf | m' | PSI | PSI (m=0) | Hi0 | Hi0 (1-Hi0) | Deriv-Psi | Benef BD | Net gr. Effc | mi= EM5 | Hi(1-Hi)/ (1-mi) | Benef. M Inc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | 0.75 | 0.78 | 4.62 | 4.84 | 4.50 | 0.01 | 0.43 | 0.27 | 0.28 | 0.44 | 0.19 | 1.56 | 0.17 | 0.17 | 0.41 | 0.24 | 1.48 | Benef. | 2.04 | 0.44 | 0.44 | true |
| Thailand | 0.75 | | 4.96 | 3.45 | 4.31 | 0.01 | 0.45 | 0.24 | 0.25 | 0.45 | 0.23 | 1.56 | 0.14 | 0.14 | 0.36 | 0.23 | 1.47 | Benef. | 2.08 | 0.59 | 0.60 | true |
| Indonesia | 0.66 | 0.68 | 3.23 | 0.65 | 4.77 | 0.02 | 0.46 | 0.17 | 0.17 | 0.47 | 0.31 | 1.56 | 0.12 | 0.12 | 0.27 | 0.20 | 1.47 | Benef. | 2.15 | 0.21 | 0.31 | true |
| Paraguay | 0.74 | 0.75 | 3.17 | 3.47 | -0.30 | 0.02 | 0.46 | 0.25 | 0.25 | 0.47 | 0.24 | 1.57 | 0.15 | 0.14 | 0.37 | 0.23 | 1.45 | Benef. | 2.12 | 0.61 | 0.64 | true |
| Argentina | 0.83 | 0.86 | 5.99 | 3.20 | -0.52 | 0.02 | 0.48 | 0.29 | 0.30 | 0.49 | 0.22 | 1.57 | 0.10 | 0.09 | 0.36 | 0.23 | 1.45 | Benef. | 2.23 | 1.15 | -1.65 | true |
| China | 0.68 | | 2.85 | 2.03 | 7.94 | 0.02 | 0.48 | 0.23 | 0.23 | 0.49 | 0.28 | 1.57 | 0.15 | 0.14 | 0.34 | 0.23 | 1.42 | Benef. | 2.22 | 0.20 | 0.31 | true |
| Myanmar | | | | | | 0.02 | | | | | | 1.57 | 0.42 | 0.41 | 0.41 | 0.24 | 1.42 | Benef. | | 0.19 | | |
| Peru | 0.73 | | 4.13 | 2.60 | 3.13 | 0.03 | 0.47 | 0.35 | 0.36 | 0.48 | 0.16 | 1.58 | 0.13 | 0.12 | 0.45 | 0.25 | 1.41 | Benef. | 2.18 | 2.31 | -0.19 | true |
| Nepal | 0.47 | 0.50 | 2.00 | 2.07 | 6.45 | 0.03 | 0.47 | 0.14 | 0.14 | 0.49 | 0.36 | 1.58 | 0.25 | 0.24 | 0.37 | 0.23 | 1.40 | Benef. | 2.19 | 0.18 | 0.31 | true |
| Bangladesh | 0.45 | 0.51 | 0.82 | 1.71 | 5.94 | 0.03 | 0.36 | 0.17 | 0.17 | 0.37 | 0.22 | 1.58 | 0.25 | 0.24 | 0.39 | 0.24 | 1.39 | Benef. | 1.74 | 0.35 | 0.36 | true |
| Bolivia | 0.64 | 0.67 | 3.78 | 5.53 | 2.37 | 0.03 | 0.51 | 0.29 | 0.30 | 0.52 | 0.25 | 1.58 | 0.24 | 0.23 | 0.50 | 0.25 | 1.39 | Benef. | 2.33 | 1.44 | -0.57 | true |
| India | 0.55 | 0.58 | 2.79 | 3.35 | 3.92 | 0.03 | 0.61 | 0.15 | 0.16 | 0.62 | 0.48 | 1.59 | 0.24 | 0.23 | 0.37 | 0.23 | 1.37 | Benef. | 2.66 | 0.28 | 0.33 | true |
| Egypt | 0.61 | | 3.82 | 4.41 | 5.12 | 0.03 | 0.59 | 0.20 | 0.21 | 0.60 | 0.41 | 1.59 | 0.23 | 0.22 | 0.41 | 0.24 | 1.37 | Benef. | 2.61 | 0.72 | 0.85 | true |
| Venezuela | 0.77 | 0.77 | 4.78 | 5.01 | 3.21 | 0.04 | 0.60 | 0.25 | 0.26 | 0.61 | 0.37 | 1.59 | 0.17 | 0.16 | 0.39 | 0.24 | 1.36 | Benef. | 2.64 | 1.41 | -0.58 | true |
| Swaziland | 0.60 | 0.53 | 8.80 | 6.50 | 2.55 | 0.04 | 0.56 | 0.22 | 0.22 | 0.56 | 0.37 | 1.59 | 0.28 | 0.27 | 0.46 | 0.25 | 1.36 | Benef. | 2.51 | 0.34 | 0.37 | true |
| | | | | | | | | | | | | | | | | | | | | | | |
| Guyana | 0.69 | 0.71 | | 3.30 | -0.70 | 0.77 | 0.44 | 0.32 | 0.84 | 0.88 | 0.12 | 1.43 | 0.13 | 0.16 | 0.92 | 0.08 | -0.96 | Benef. | 2.07 | 36.48 | 0.00 | false |
| Jamaica | 0.72 | 0.73 | 5.09 | 6.84 | 0.79 | 0.73 | 0.43 | 0.32 | 0.76 | 0.83 | 0.15 | 1.47 | 0.20 | 0.22 | 0.90 | 0.09 | -0.96 | Benef. | 2.01 | 30.60 | 0.00 | false |
| Guinea-Bissau | 0.34 | 0.35 | | 2.67 | 7.50 | 0.70 | 0.14 | 0.03 | 0.03 | 0.18 | 0.15 | 1.49 | 0.30 | 0.31 | 0.34 | 0.22 | -0.95 | Benef. | 0.71 | 3.62 | -0.06 | false |
| Haiti | 0.45 | | 0.86 | 1.59 | 1.12 | 0.68 | 0.39 | 0.38 | 0.74 | 0.80 | 0.13 | 1.51 | 0.23 | 0.24 | 0.90 | 0.09 | -0.95 | Benef. | 1.85 | 8.79 | -0.02 | false |
| Trinidad and Tobago | 0.79 | 0.80 | | 3.44 | 4.78 | 0.66 | 0.51 | 0.33 | 0.69 | 0.83 | 0.21 | 1.53 | 0.11 | 0.12 | 0.74 | 0.19 | -0.94 | Benef. | 2.33 | 22.13 | -0.01 | false |
| Mozambique | 0.33 | 0.36 | 0.52 | 3.69 | 1.60 | 0.52 | 0.18 | 0.03 | 0.03 | 0.28 | 0.25 | 1.65 | 0.37 | 0.34 | 0.37 | 0.23 | -0.78 | Benef. | 0.88 | 0.82 | 1.16 | false |
| Mauritius | 0.75 | 0.78 | 4.97 | 3.25 | 8.02 | 0.50 | 0.29 | 0.16 | 0.35 | 0.48 | 0.16 | 1.67 | 0.17 | 0.13 | 0.45 | 0.25 | -0.74 | Benef. | 1.41 | 9.33 | -0.03 | false |
| Barbados | 0.85 | 0.88 | 4.92 | | | 0.47 | 0.43 | 0.33 | 0.60 | 0.68 | 0.14 | 1.69 | 0.05 | 0.01 | 0.55 | 0.25 | -0.68 | Benef. | 2.03 | 29.45 | -0.01 | false |
| Fiji | 0.74 | | | 4.86 | -7.99 | 0.43 | 0.43 | 0.28 | 0.54 | 0.67 | 0.18 | 1.71 | 0.22 | 0.17 | 0.65 | 0.23 | -0.56 | Benef. | 2.02 | 17.81 | -0.01 | false |
| Gambia | 0.42 | 0.46 | | | 5.60 | 0.42 | 0.20 | 0.20 | 0.56 | 0.41 | -0.09 | 1.72 | 0.26 | 0.21 | 0.72 | 0.20 | -0.55 | Benef. | 1.01 | 2.58 | -0.15 | false |
| Congo | 0.53 | | | | 7.90 | 0.34 | 0.41 | 0.12 | 0.13 | 0.47 | 0.35 | 1.75 | 0.22 | 0.16 | 0.28 | 0.20 | -0.24 | Benef. | 1.92 | 3.53 | -0.10 | false |
| Sierra Leone | | | 1.09 | 1.07 | 6.96 | 0.32 | 0.50 | 0.18 | 0.25 | 0.68 | 0.46 | 1.75 | 0.49 | 0.44 | 0.66 | 0.22 | -0.18 | Benef. | 2.31 | 1.42 | -0.51 | true |
| Ghana | 0.53 | 0.56 | 1.60 | 4.43 | 3.70 | 0.31 | 0.44 | 0.16 | 0.24 | 0.60 | 0.38 | 1.76 | 0.32 | 0.26 | 0.47 | 0.25 | -0.13 | Benef. | 2.06 | 1.47 | -0.51 | true |
| Kenya | 0.52 | 0.50 | 1.79 | 6.12 | -0.24 | 0.28 | 0.45 | 0.12 | 0.20 | 0.57 | 0.39 | 1.76 | 0.36 | 0.30 | 0.47 | 0.25 | 0.03 | Benef. | 2.09 | 1.13 | -1.95 | true |
| Cyprus | | | | | | 0.26 | | | | | | 1.76 | 0.47 | 0.41 | 0.41 | 0.24 | 0.12 | Benef. | | 19.28 | | |

**Table 4: Evaluation of the Beneficial Brain Drain Effect (using $d_h = 0.1$)**

| Developing country | HDI 1995 | KEI 1995 | ASEExp | GDP growth 2000 | EM1 1990 | humi 2000 | Hi 1990 | Hi 2000 | Hi transf= Δhi+ dh*hilag | m' | PSI | PSI (m=0) | $\tilde{H}_i$ | $\tilde{H}_i(1-\tilde{H}_i)$ | deriv-psi | Benef Brain Drain | Net growth effect | mi= EM5 | Hi(1-Hi)/ (1-mi) | Benef mig incr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bangladesh | 0.45 | 0.82 | 1.71 | 5.94 | 0.02 | 0.36 | 0.17 | 0.37 | 0.22 | 1.57 | 0.25 | 0.24 | 0.39 | 0.24 | 1.44 | Benef. | 1.74 | 0.35 | 0.36 | true |
| Benin | 0.40 | 1.70 | 2.71 | 5.80 | 0.07 | 0.53 | 0.14 | 0.56 | 0.43 | 1.64 | 0.31 | 0.29 | 0.41 | 0.24 | 1.16 | Benef. | 2.39 | 0.41 | 0.42 | true |
| Burkina Faso | 0.31 | 0.98 | 1.38 | 2.15 | 0.02 | 0.30 | 0.11 | 0.31 | 0.21 | 1.56 | 0.30 | 0.30 | 0.39 | 0.24 | 1.47 | Benef. | 1.46 | 0.14 | 0.25 | true |
| Cameroon | 0.49 | 1.34 | 2.32 | 4.20 | 0.13 | 0.50 | 0.14 | 0.54 | 0.42 | 1.70 | 0.27 | 0.23 | 0.36 | 0.23 | 0.83 | Benef. | 2.28 | 0.65 | 0.71 | true |
| Côte d'Ivoire | 0.43 | 1.30 | 4.54 | -2.30 | 0.03 | 0.31 | 0.12 | 0.32 | 0.21 | 1.58 | 0.32 | 0.31 | 0.42 | 0.24 | 1.40 | Benef. | 1.49 | 0.69 | 0.71 | true |
| Ethiopia | 0.32 | 0.76 | 2.70 | 5.44 | 0.08 | 0.49 | 0.23 | 0.51 | 0.31 | 1.65 | 0.35 | 0.32 | 0.52 | 0.25 | 1.12 | Benef. | 2.24 | 0.36 | 0.39 | true |
| Ghana | 0.53 | 1.60 | 4.43 | 3.70 | 0.38 | 0.44 | 0.24 | 0.60 | 0.38 | 1.74 | 0.31 | 0.26 | 0.47 | 0.25 | -0.39 | Benef. | 2.06 | 1.47 | -0.51 | true |
| Haiti | 0.45 | 0.86 | 1.59 | 1.12 | 0.79 | 0.39 | 0.74 | 0.80 | 0.13 | 1.41 | 0.20 | 0.24 | 0.90 | 0.09 | -0.96 | Benef. | 1.85 | 8.79 | -0.02 | false |
| India | 0.55 | 2.79 | 3.35 | 3.92 | 0.03 | 0.61 | 0.16 | 0.62 | 0.48 | 1.58 | 0.24 | 0.23 | 0.37 | 0.23 | 1.40 | Benef. | 2.66 | 0.28 | 0.33 | true |
| Kenya | 0.52 | 1.79 | 6.12 | -0.24 | 0.43 | 0.45 | 0.20 | 0.57 | 0.39 | 1.71 | 0.34 | 0.30 | 0.47 | 0.25 | -0.56 | Benef. | 2.09 | 1.13 | -1.95 | true |
| Madagascar | 0.46 | 0.84 | 1.84 | 4.80 | 0.06 | 0.43 | 0.16 | 0.45 | 0.31 | 1.62 | 0.26 | 0.24 | 0.38 | 0.24 | 1.25 | Benef. | 2.04 | 0.87 | 1.86 | false |
| Malawi | 0.41 | 1.80 | 3.83 | 1.67 | 0.17 | 0.43 | 0.15 | 0.48 | 0.35 | 1.72 | 0.35 | 0.30 | 0.43 | 0.25 | 0.62 | Benef. | 2.03 | 0.26 | 0.34 | true |
| Mozambique | 0.33 | 0.52 | 3.69 | 1.60 | 0.27 | 0.18 | 0.03 | 0.28 | 0.25 | 1.76 | 0.40 | 0.34 | 0.37 | 0.23 | 0.09 | Benef. | 0.88 | 0.82 | 1.16 | false |
| Nepal | 0.47 | 2.00 | 2.07 | 6.45 | 0.02 | 0.47 | 0.14 | 0.49 | 0.36 | 1.57 | 0.25 | 0.24 | 0.37 | 0.23 | 1.45 | Benef. | 2.19 | 0.18 | 0.31 | true |
| Nicaragua | 0.64 | 2.17 | 2.64 | 4.29 | 0.30 | 0.39 | 0.45 | 0.47 | 0.06 | 1.76 | 0.23 | 0.17 | 0.58 | 0.24 | -0.06 | Benef. | 1.83 | 6.96 | -0.04 | false |
| Nigeria | 0.42 | 1.63 | 0.80 | 3.78 | 0.08 | 0.65 | 0.11 | 0.68 | 0.58 | 1.65 | 0.26 | 0.23 | 0.33 | 0.22 | 1.12 | Benef. | 2.79 | 0.36 | 0.34 | true |
| Pakistan | 0.49 | 1.81 | 2.39 | 4.43 | 0.07 | 0.39 | 0.18 | 0.42 | 0.26 | 1.63 | 0.26 | 0.23 | 0.39 | 0.24 | 1.18 | Benef. | 1.84 | 0.80 | 1.22 | false |
| Senegal | 0.42 | 1.77 | 3.44 | 5.60 | 0.12 | 0.17 | 0.09 | 0.20 | 0.12 | 1.69 | 0.33 | 0.29 | 0.37 | 0.23 | 0.88 | Benef. | 0.83 | 2.44 | -0.11 | true |
| Sudan | 0.47 | 0.65 | 0.86 | 8.30 | 0.05 | 0.52 | 0.19 | 0.54 | 0.37 | 1.61 | 0.23 | 0.21 | 0.38 | 0.24 | 1.28 | Benef. | 2.37 | 0.22 | 0.32 | true |
| Tanzania | 0.42 | 1.04 | 3.40 | 5.07 | 0.12 | 0.51 | 0.15 | 0.55 | 0.41 | 1.68 | 0.33 | 0.29 | 0.42 | 0.24 | 0.92 | Benef. | 2.34 | 0.37 | 0.40 | true |
| Uganda | 0.41 | 1.18 | 2.19 | 3.50 | 0.44 | 0.46 | 0.19 | 0.57 | 0.40 | 1.71 | 0.31 | 0.27 | 0.44 | 0.25 | -0.60 | Benef. | 2.15 | 0.68 | 0.75 | false |
| Zambia | 0.42 | 2.72 | 1.99 | 3.47 | 0.17 | 0.49 | 0.18 | 0.53 | 0.37 | 1.72 | 0.31 | 0.26 | 0.42 | 0.24 | 0.63 | Benef. | 2.24 | 0.64 | 0.69 | false |
| Zimbabwe | 0.59 | 2.97 | 7.47 | -4.88 | 0.08 | 0.55 | 0.16 | 0.58 | 0.44 | 1.64 | 0.32 | 0.29 | 0.44 | 0.25 | 1.15 | Benef. | 2.47 | 1.09 | -2.63 | true |
| Algeria | 0.67 | 2.04 | 4.50 | 2.40 | 0.07 | 0.14 | 0.05 | 0.15 | 0.11 | 1.64 | 0.22 | 0.19 | 0.23 | 0.18 | 1.17 | Benef. | 0.70 | 6.17 | -0.03 | true |
| Bolivia | 0.64 | 3.78 | 5.53 | 2.37 | 0.06 | 0.51 | 0.30 | 0.52 | 0.25 | 1.63 | 0.26 | 0.23 | 0.50 | 0.25 | 1.21 | Benef. | 2.33 | 1.44 | -0.57 | true |
| Brazil | 0.75 | 4.62 | 4.84 | 4.50 | 0.02 | 0.43 | 0.28 | 0.44 | 0.19 | 1.56 | 0.17 | 0.17 | 0.41 | 0.24 | 1.47 | Benef. | 2.04 | 0.44 | 0.44 | true |
| Bulgaria | 0.78 | 6.08 | 3.15 | 5.80 | 0.04 | 0.16 | 0.21 | 0.17 | -0.02 | 1.59 | 0.13 | 0.11 | 0.30 | 0.21 | 1.35 | Benef. | 0.81 | 8.01 | -0.02 | true |
| China | 0.68 | 2.85 | 2.03 | 7.94 | 0.03 | 0.48 | 0.23 | 0.49 | 0.28 | 1.58 | 0.15 | 0.14 | 0.34 | 0.23 | 1.39 | Benef. | 2.22 | 0.20 | 0.31 | true |
| Colombia | 0.75 | 4.47 | 3.13 | 2.81 | 0.09 | 0.42 | 0.44 | 0.44 | 0.05 | 1.66 | 0.16 | 0.13 | 0.52 | 0.25 | 1.06 | Benef. | 1.97 | 2.34 | -0.18 | true |
| Dominican Republic | 0.70 | 3.39 | 2.10 | 7.75 | 0.18 | 0.27 | 0.44 | 0.32 | -0.08 | 1.73 | 0.18 | 0.13 | 0.53 | 0.25 | 0.54 | Benef. | 1.30 | 11.04 | -0.02 | true |
| Ecuador | 0.73 | 3.44 | 3.17 | 2.33 | 0.06 | 0.28 | 0.44 | 0.30 | -0.10 | 1.62 | 0.16 | 0.14 | 0.54 | 0.25 | 1.26 | Benef. | 1.37 | 5.66 | -0.05 | true |
| Egypt | 0.61 | 3.82 | 4.41 | 5.12 | 0.06 | 0.59 | 0.21 | 0.60 | 0.41 | 1.62 | 0.24 | 0.22 | 0.41 | 0.24 | 1.24 | Benef. | 2.61 | 0.72 | 0.85 | true |
| El Salvador | 0.69 | 3.76 | 2.18 | 1.97 | 0.33 | 0.19 | 0.45 | 0.25 | -0.15 | 1.75 | 0.19 | 0.14 | 0.54 | 0.25 | -0.20 | Benef. | 0.95 | 17.09 | -0.01 | false |
| Guatemala | 0.62 | 1.70 | 1.52 | 3.33 | 0.20 | 0.19 | 0.31 | 0.24 | -0.05 | 1.74 | 0.21 | 0.16 | 0.44 | 0.25 | 0.42 | Benef. | 0.94 | 6.89 | -0.03 | true |

| Developing country | HDI 1995 | KEI 1995 | ASEExp | GDP growth 2000 | EM1 1990 | humi 2000 | Hi 1990 | Hi 2000 | Hi transf= Δhi+ dh*hilag | m' | PSI | PSI (m=0) | $\tilde{H}_i$ | $\tilde{H}_i(1-\tilde{H}_i)$ | deriv-psi | Benef Brain Drain | Net growth effect | mi= EM5 | Hi(1-Hi)/ (1-mi) | Benef mig incr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Honduras | 0.64 | 2.93 | 3.48 | 4.79 | 0.22 | 0.24 | 0.44 | 0.29 | -0.11 | 1.75 | 0.24 | 0.19 | 0.59 | 0.24 | 0.32 | Benef. | 1.17 | 6.72 | -0.04 | true |
| Indonesia | 0.66 | 3.23 | 0.65 | 4.77 | 0.04 | 0.46 | 0.17 | 0.47 | 0.31 | 1.60 | 0.13 | 0.12 | 0.27 | 0.20 | 1.34 | Benef. | 2.15 | 0.21 | 0.31 | true |
| Iran | 0.69 | 2.99 | 3.19 | 5.37 | 0.25 | 0.59 | 0.27 | 0.62 | 0.38 | 1.75 | 0.21 | 0.16 | 0.40 | 0.24 | 0.16 | Benef. | 2.59 | 1.43 | -0.54 | true |
| Jamaica | 0.72 | 5.09 | 6.84 | 0.79 | 0.85 | 0.43 | 0.76 | 0.83 | 0.15 | 1.35 | 0.17 | 0.22 | 0.90 | 0.09 | -0.94 | Benef. | 2.01 | 30.60 | 0.00 | false |
| Jordan | 0.71 | 4.04 | 5.61 | 3.88 | 0.09 | 0.56 | 0.29 | 0.57 | 0.32 | 1.65 | 0.23 | 0.20 | 0.46 | 0.25 | 1.09 | Benef. | 2.50 | 2.05 | -0.23 | true |
| Morocco | 0.58 | 2.93 | 4.72 | 0.87 | 0.22 | 0.13 | 0.12 | 0.15 | 0.04 | 1.75 | 0.30 | 0.24 | 0.35 | 0.23 | 0.35 | Benef. | 0.64 | 7.23 | -0.02 | true |
| Paraguay | 0.74 | 3.17 | 3.47 | -0.30 | 0.04 | 0.46 | 0.25 | 0.47 | 0.24 | 1.59 | 0.15 | 0.14 | 0.37 | 0.23 | 1.36 | Benef. | 2.12 | 0.61 | 0.64 | true |
| Peru | 0.73 | 4.13 | 2.60 | 3.13 | 0.06 | 0.47 | 0.36 | 0.48 | 0.16 | 1.62 | 0.15 | 0.12 | 0.45 | 0.25 | 1.25 | Benef. | 2.18 | 2.31 | -0.19 | true |
| Philippines | 0.74 | 4.18 | 2.91 | 4.01 | 0.13 | 0.67 | 0.21 | 0.70 | 0.51 | 1.69 | 0.17 | 0.13 | 0.32 | 0.22 | 0.84 | Benef. | 2.85 | 3.81 | -0.07 | true |
| Romania | 0.77 | 5.34 | 3.32 | 1.64 | 0.09 | 0.31 | 0.27 | 0.34 | 0.10 | 1.66 | 0.16 | 0.12 | 0.37 | 0.23 | 1.06 | Benef. | 1.52 | 3.61 | -0.09 | true |
| Sri Lanka | 0.73 | 3.34 | 2.65 | 6.00 | 0.29 | 0.40 | 0.27 | 0.48 | 0.24 | 1.76 | 0.19 | 0.13 | 0.37 | 0.23 | -0.01 | Benef. | 1.88 | 2.24 | -0.20 | true |
| Swaziland | 0.60 | 8.80 | 6.50 | 2.55 | 0.00 | 0.56 | 0.22 | 0.56 | 0.37 | 1.54 | 0.27 | 0.27 | 0.46 | 0.25 | 1.53 | Benef. | 2.51 | 0.34 | 0.37 | true |
| Syrian Arab Republic | 0.67 | 2.36 | 2.60 | 2.50 | 0.07 | 0.44 | 0.23 | 0.46 | 0.25 | 1.63 | 0.18 | 0.15 | 0.36 | 0.23 | 1.18 | Benef. | 2.07 | 1.30 | -0.84 | true |
| Thailand | 0.75 | 4.96 | 3.45 | 4.31 | 0.02 | 0.45 | 0.25 | 0.45 | 0.23 | 1.57 | 0.14 | 0.14 | 0.36 | 0.23 | 1.42 | Benef. | 2.08 | 0.59 | 0.60 | true |
| Tunisia | 0.70 | 3.41 | 6.63 | 4.71 | 0.18 | 0.15 | 0.11 | 0.17 | 0.07 | 1.73 | 0.28 | 0.23 | 0.32 | 0.22 | 0.56 | Benef. | 0.74 | 5.86 | -0.03 | true |
| Argentina | 0.83 | 5.99 | 3.20 | -0.52 | 0.04 | 0.48 | 0.30 | 0.49 | 0.22 | 1.59 | 0.10 | 0.09 | 0.36 | 0.23 | 1.36 | Benef. | 2.23 | 1.15 | -1.65 | true |
| Botswana | 0.66 | 4.07 | 7.80 | 3.43 | 0.02 | 0.34 | 0.12 | 0.35 | 0.24 | 1.57 | 0.28 | 0.27 | 0.38 | 0.23 | 1.43 | Benef. | 1.63 | 0.44 | 0.40 | true |
| Chile | 0.82 | 6.19 | 3.41 | 5.38 | 0.07 | 0.47 | 0.33 | 0.49 | 0.19 | 1.63 | 0.13 | 0.10 | 0.40 | 0.24 | 1.19 | Benef. | 2.20 | 1.84 | -0.30 | true |
| Costa Rica | 0.81 | 5.88 | 5.07 | 1.66 | 0.08 | 0.45 | 0.40 | 0.47 | 0.11 | 1.65 | 0.17 | 0.14 | 0.50 | 0.25 | 1.11 | Benef. | 2.10 | 2.80 | -0.14 | true |
| Hungary | 0.81 | 6.73 | 4.58 | 5.15 | 0.14 | 0.39 | 0.29 | 0.43 | 0.17 | 1.71 | 0.17 | 0.13 | 0.39 | 0.24 | 0.76 | Benef. | 1.86 | 3.60 | -0.09 | true |
| Malaysia | 0.76 | 5.38 | 4.26 | 8.30 | 0.25 | 0.59 | 0.19 | 0.62 | 0.45 | 1.75 | 0.20 | 0.15 | 0.32 | 0.22 | 0.19 | Benef. | 2.62 | 1.35 | -0.67 | true |
| Mauritius | 0.75 | 4.97 | 3.25 | 8.02 | 0.65 | 0.29 | 0.35 | 0.48 | 0.16 | 1.54 | 0.13 | 0.13 | 0.45 | 0.25 | -0.93 | Benef. | 1.41 | 9.33 | -0.03 | false |
| Mexico | 0.78 | 5.17 | 4.53 | 6.86 | 0.11 | 0.14 | 0.31 | 0.17 | -0.11 | 1.67 | 0.18 | 0.14 | 0.42 | 0.24 | 0.97 | Benef. | 0.72 | 11.33 | -0.01 | true |
| Poland | 0.82 | 6.38 | 5.06 | 4.00 | 0.14 | 0.40 | 0.28 | 0.43 | 0.18 | 1.71 | 0.18 | 0.14 | 0.39 | 0.24 | 0.76 | Benef. | 1.88 | 3.93 | -0.08 | true |
| South Africa | 0.74 | 5.73 | 6.94 | 3.08 | 0.10 | 0.63 | 0.22 | 0.64 | 0.45 | 1.67 | 0.25 | 0.21 | 0.41 | 0.24 | 1.02 | Benef. | 2.72 | 1.14 | -1.58 | true |
| Turkey | 0.71 | 5.20 | 3.17 | 7.22 | 0.08 | 0.09 | 0.12 | 0.09 | -0.01 | 1.65 | 0.18 | 0.15 | 0.25 | 0.19 | 1.11 | Benef. | 0.44 | 3.98 | -0.03 | true |
| Uruguay | 0.82 | 6.24 | 3.03 | -1.27 | 0.07 | 0.41 | 0.36 | 0.43 | 0.11 | 1.63 | 0.12 | 0.09 | 0.41 | 0.24 | 1.18 | Benef. | 1.95 | 2.89 | -0.13 | true |
| Venezuela | 0.77 | 4.78 | 5.01 | 3.21 | 0.04 | 0.60 | 0.26 | 0.61 | 0.37 | 1.59 | 0.17 | 0.16 | 0.39 | 0.24 | 1.35 | Benef. | 2.64 | 1.41 | -0.58 | true |

ASEExp: Adjusted savings: education expenditure (% of GNI) 2000

**$d_h$ = 0.1**

m' = (1+m)/ (0.65 + m²)

Deriv-PSIzero = 1.538

**Table 5: Evaluation of the Beneficial Brain Drain Effect (using $d_h = 0.05$)**

| Developing country | HDI 1995 | KEI 1995 | ASE Exp. | GDP growth 2000 | EM1 1990 | humi 2000 | Hi 1990 | Hi 2000 | Hi transf= Δhi+ dh*hilag | m' | PSI | PSI (m=0) | $\tilde{H}_i$ | $\tilde{H}_i(1-\tilde{H}_i)$ | deriv-psi | Benef Brain Drain | Net grwth effect | mi= EM5 | Hi(1-Hi)/ (1-mi) | Benef mig incr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bangladesh | 0.45 | 0.82 | 1.71 | 5.94 | 0.02 | 0.36 | 0.17 | 0.37 | 0.21 | 1.57 | 0.25 | 0.24 | 0.40 | 0.24 | 1.44 | Benef. | 1.74 | 0.35 | 0.36 | true |
| Benin | 0.40 | 1.70 | 2.71 | 5.80 | 0.07 | 0.53 | 0.14 | 0.56 | 0.42 | 1.64 | 0.31 | 0.29 | 0.42 | 0.24 | 1.16 | Benef. | 2.39 | 0.41 | 0.42 | true |
| Burkina Faso | 0.31 | 0.98 | 1.38 | 2.15 | 0.02 | 0.30 | 0.11 | 0.31 | 0.21 | 1.56 | 0.30 | 0.30 | 0.40 | 0.24 | 1.47 | Benef. | 1.46 | 0.14 | 0.25 | true |
| Cameroon | 0.49 | 1.34 | 2.32 | 4.20 | 0.13 | 0.50 | 0.14 | 0.54 | 0.41 | 1.70 | 0.27 | 0.23 | 0.36 | 0.23 | 0.83 | Benef. | 2.28 | 0.65 | 0.71 | true |
| Côte d'Ivoire | 0.43 | 1.30 | 4.54 | -2.30 | 0.03 | 0.31 | 0.12 | 0.32 | 0.21 | 1.58 | 0.32 | 0.31 | 0.42 | 0.24 | 1.40 | Benef. | 1.49 | 0.69 | 0.71 | true |
| Ethiopia | 0.32 | 0.76 | 2.70 | 5.44 | 0.08 | 0.49 | 0.23 | 0.51 | 0.30 | 1.65 | 0.35 | 0.32 | 0.53 | 0.25 | 1.12 | Benef. | 2.24 | 0.36 | 0.39 | true |
| Ghana | 0.53 | 1.60 | 4.43 | 3.70 | 0.38 | 0.44 | 0.24 | 0.60 | 0.37 | 1.74 | 0.31 | 0.26 | 0.49 | 0.25 | -0.39 | Benef. | 2.06 | 1.47 | -0.51 | true |
| Haiti | 0.45 | 0.86 | 1.59 | 1.12 | 0.79 | 0.39 | 0.74 | 0.80 | 0.09 | 1.41 | 0.20 | 0.24 | 0.94 | 0.06 | -0.96 | Benef. | 1.85 | 8.79 | -0.02 | false |
| India | 0.55 | 2.79 | 3.35 | 3.92 | 0.03 | 0.61 | 0.16 | 0.62 | 0.47 | 1.58 | 0.24 | 0.23 | 0.38 | 0.23 | 1.40 | Benef. | 2.66 | 0.28 | 0.33 | true |
| Kenya | 0.52 | 1.79 | 6.12 | -0.24 | 0.43 | 0.45 | 0.20 | 0.57 | 0.38 | 1.71 | 0.34 | 0.30 | 0.48 | 0.25 | -0.56 | Benef. | 2.09 | 1.13 | -1.95 | true |
| Madagascar | 0.46 | 0.84 | 1.84 | 4.80 | 0.06 | 0.43 | 0.16 | 0.45 | 0.30 | 1.62 | 0.26 | 0.24 | 0.39 | 0.24 | 1.25 | Benef. | 2.04 | 0.87 | 1.86 | false |
| Malawi | 0.41 | 1.80 | 3.83 | 1.67 | 0.17 | 0.43 | 0.15 | 0.48 | 0.35 | 1.72 | 0.35 | 0.30 | 0.44 | 0.25 | 0.62 | Benef. | 2.03 | 0.26 | 0.34 | true |
| Mozambique | 0.33 | 0.52 | 3.69 | 1.60 | 0.27 | 0.18 | 0.03 | 0.28 | 0.25 | 1.76 | 0.40 | 0.34 | 0.37 | 0.23 | 0.09 | Benef. | 0.88 | 0.82 | 1.16 | false |
| Nepal | 0.47 | 2.00 | 2.07 | 6.45 | 0.02 | 0.47 | 0.14 | 0.49 | 0.35 | 1.57 | 0.25 | 0.24 | 0.37 | 0.23 | 1.45 | Benef. | 2.19 | 0.18 | 0.31 | true |
| Nicaragua | 0.64 | 2.17 | 2.64 | 4.29 | 0.30 | 0.39 | 0.45 | 0.47 | 0.04 | 1.76 | 0.23 | 0.17 | 0.60 | 0.24 | -0.06 | Benef. | 1.83 | 6.96 | -0.04 | false |
| Nigeria | 0.42 | 1.63 | 0.80 | 3.78 | 0.08 | 0.65 | 0.11 | 0.68 | 0.57 | 1.65 | 0.26 | 0.23 | 0.34 | 0.22 | 1.12 | Benef. | 2.79 | 0.36 | 0.34 | true |
| Pakistan | 0.49 | 1.81 | 2.39 | 4.43 | 0.07 | 0.39 | 0.18 | 0.42 | 0.25 | 1.63 | 0.26 | 0.23 | 0.40 | 0.24 | 1.18 | Benef. | 1.84 | 0.80 | 1.22 | false |
| Senegal | 0.42 | 1.77 | 3.44 | 5.60 | 0.12 | 0.17 | 0.09 | 0.20 | 0.11 | 1.69 | 0.33 | 0.29 | 0.37 | 0.23 | 0.88 | Benef. | 0.83 | 2.44 | -0.11 | true |
| Sudan | 0.47 | 0.65 | 0.86 | 8.30 | 0.05 | 0.52 | 0.19 | 0.54 | 0.36 | 1.61 | 0.23 | 0.21 | 0.39 | 0.24 | 1.28 | Benef. | 2.37 | 0.22 | 0.32 | true |
| Tanzania | 0.42 | 1.04 | 3.40 | 5.07 | 0.12 | 0.51 | 0.15 | 0.55 | 0.40 | 1.68 | 0.33 | 0.29 | 0.43 | 0.24 | 0.92 | Benef. | 2.34 | 0.37 | 0.40 | true |
| Uganda | 0.41 | 1.18 | 2.19 | 3.50 | 0.44 | 0.46 | 0.19 | 0.57 | 0.39 | 1.71 | 0.31 | 0.27 | 0.45 | 0.25 | -0.60 | Benef. | 2.15 | 0.68 | 0.75 | false |
| Zambia | 0.42 | 2.72 | 1.99 | 3.47 | 0.17 | 0.49 | 0.18 | 0.53 | 0.36 | 1.72 | 0.31 | 0.26 | 0.42 | 0.24 | 0.63 | Benef. | 2.24 | 0.64 | 0.69 | false |
| Zimbabwe | 0.59 | 2.97 | 7.47 | -4.88 | 0.08 | 0.55 | 0.16 | 0.58 | 0.43 | 1.64 | 0.32 | 0.29 | 0.45 | 0.25 | 1.15 | Benef. | 2.47 | 1.09 | -2.63 | true |
| Algeria | 0.67 | 2.04 | 4.50 | 2.40 | 0.07 | 0.14 | 0.05 | 0.15 | 0.11 | 1.64 | 0.22 | 0.19 | 0.24 | 0.18 | 1.17 | Benef. | 0.70 | 6.17 | -0.03 | true |
| Bolivia | 0.64 | 3.78 | 5.53 | 2.37 | 0.06 | 0.51 | 0.30 | 0.52 | 0.24 | 1.63 | 0.26 | 0.23 | 0.52 | 0.25 | 1.21 | Benef. | 2.33 | 1.44 | -0.57 | true |
| Brazil | 0.75 | 4.62 | 4.84 | 4.50 | 0.02 | 0.43 | 0.28 | 0.44 | 0.18 | 1.56 | 0.17 | 0.17 | 0.43 | 0.24 | 1.47 | Benef. | 2.04 | 0.44 | 0.44 | true |
| Bulgaria | 0.78 | 6.08 | 3.15 | 5.80 | 0.04 | 0.16 | 0.21 | 0.17 | -0.03 | 1.59 | 0.13 | 0.11 | 0.31 | 0.22 | 1.35 | Benef. | 0.81 | 8.01 | -0.02 | true |
| China | 0.68 | 2.85 | 2.03 | 7.94 | 0.03 | 0.48 | 0.23 | 0.49 | 0.27 | 1.58 | 0.15 | 0.14 | 0.36 | 0.23 | 1.39 | Benef. | 2.22 | 0.20 | 0.31 | true |
| Colombia | 0.75 | 4.47 | 3.13 | 2.81 | 0.09 | 0.42 | 0.44 | 0.44 | 0.03 | 1.66 | 0.16 | 0.13 | 0.54 | 0.25 | 1.06 | Benef. | 1.97 | 2.34 | -0.18 | true |
| Dominican Republic | 0.70 | 3.39 | 2.10 | 7.75 | 0.18 | 0.27 | 0.44 | 0.32 | -0.10 | 1.73 | 0.18 | 0.13 | 0.55 | 0.25 | 0.54 | Benef. | 1.30 | 11.04 | -0.02 | true |
| Ecuador | 0.73 | 3.44 | 3.17 | 2.33 | 0.06 | 0.28 | 0.44 | 0.30 | -0.12 | 1.62 | 0.16 | 0.14 | 0.56 | 0.25 | 1.26 | Benef. | 1.37 | 5.66 | -0.05 | true |
| Egypt | 0.61 | 3.82 | 4.41 | 5.12 | 0.06 | 0.59 | 0.21 | 0.60 | 0.40 | 1.62 | 0.24 | 0.22 | 0.42 | 0.24 | 1.24 | Benef. | 2.61 | 0.72 | 0.85 | true |
| El Salvador | 0.69 | 3.76 | 2.18 | 1.97 | 0.33 | 0.19 | 0.45 | 0.25 | -0.17 | 1.75 | 0.19 | 0.14 | 0.57 | 0.25 | -0.20 | Benef. | 0.95 | 17.09 | -0.01 | false |

| Developing country | HDI 1995 | KEI 1995 | ASE Exp. | GDP growth 2000 | EM1 1990 | humi 2000 | Hi 1990 | Hi 2000 | Hi transf= Δhi+ dh*hilag | m' | PSI | PSI (m=0) | $\tilde{H}_i$ | $\tilde{H}_i(1-\tilde{H}_i)$ | deriv-psi | Benef Brain Drain | Net grwth effect | mi= EM5 | Hi(1-Hi)/ (1-mi) | Benef mig incr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Guatemala | 0.62 | 1.70 | 1.52 | 3.33 | 0.20 | 0.19 | 0.31 | 0.24 | -0.06 | 1.74 | 0.21 | 0.16 | 0.45 | 0.25 | 0.42 | Benef. | 0.94 | 6.89 | -0.03 | true |
| Honduras | 0.64 | 2.93 | 3.48 | 4.79 | 0.22 | 0.24 | 0.44 | 0.29 | -0.13 | 1.75 | 0.24 | 0.19 | 0.61 | 0.24 | 0.32 | Benef. | 1.17 | 6.72 | -0.04 | true |
| Indonesia | 0.66 | 3.23 | 0.65 | 4.77 | 0.04 | 0.46 | 0.17 | 0.47 | 0.30 | 1.60 | 0.13 | 0.12 | 0.28 | 0.20 | 1.34 | Benef. | 2.15 | 0.21 | 0.31 | true |
| Iran | 0.69 | 2.99 | 3.19 | 5.37 | 0.25 | 0.59 | 0.27 | 0.62 | 0.37 | 1.75 | 0.21 | 0.16 | 0.41 | 0.24 | 0.16 | Benef. | 2.59 | 1.43 | -0.54 | true |
| Jamaica | 0.72 | 5.09 | 6.84 | 0.79 | 0.85 | 0.43 | 0.76 | 0.83 | 0.12 | 1.35 | 0.17 | 0.22 | 0.94 | 0.06 | -0.94 | Benef. | 2.01 | 30.60 | 0.00 | false |
| Jordan | 0.71 | 4.04 | 5.61 | 3.88 | 0.09 | 0.56 | 0.29 | 0.57 | 0.30 | 1.65 | 0.23 | 0.20 | 0.47 | 0.25 | 1.09 | Benef. | 2.50 | 2.05 | -0.23 | true |
| Morocco | 0.58 | 2.93 | 4.72 | 0.87 | 0.22 | 0.13 | 0.12 | 0.15 | 0.04 | 1.75 | 0.30 | 0.24 | 0.36 | 0.23 | 0.35 | Benef. | 0.64 | 7.23 | -0.02 | true |
| Paraguay | 0.74 | 3.17 | 3.47 | -0.30 | 0.04 | 0.46 | 0.25 | 0.47 | 0.23 | 1.59 | 0.15 | 0.14 | 0.38 | 0.24 | 1.36 | Benef. | 2.12 | 0.61 | 0.64 | true |
| Peru | 0.73 | 4.13 | 2.60 | 3.13 | 0.06 | 0.47 | 0.36 | 0.48 | 0.14 | 1.62 | 0.15 | 0.12 | 0.46 | 0.25 | 1.25 | Benef. | 2.18 | 2.31 | -0.19 | true |
| Philippines | 0.74 | 4.18 | 2.91 | 4.01 | 0.13 | 0.67 | 0.21 | 0.70 | 0.50 | 1.69 | 0.17 | 0.13 | 0.33 | 0.22 | 0.84 | Benef. | 2.85 | 3.81 | -0.07 | true |
| Romania | 0.77 | 5.34 | 3.32 | 1.64 | 0.09 | 0.31 | 0.27 | 0.34 | 0.08 | 1.66 | 0.16 | 0.12 | 0.38 | 0.24 | 1.06 | Benef. | 1.52 | 3.61 | -0.09 | true |
| Sri Lanka | 0.73 | 3.34 | 2.65 | 6.00 | 0.29 | 0.40 | 0.27 | 0.48 | 0.23 | 1.76 | 0.19 | 0.13 | 0.38 | 0.24 | -0.01 | Benef. | 1.88 | 2.24 | -0.20 | true |
| Swaziland | 0.60 | 8.80 | 6.50 | 2.55 | 0.00 | 0.56 | 0.22 | 0.56 | 0.36 | 1.54 | 0.27 | 0.27 | 0.47 | 0.25 | 1.53 | Benef. | 2.51 | 0.34 | 0.37 | true |
| Syrian Arab Republic | 0.67 | 2.36 | 2.60 | 2.50 | 0.07 | 0.44 | 0.23 | 0.46 | 0.24 | 1.63 | 0.18 | 0.15 | 0.38 | 0.23 | 1.18 | Benef. | 2.07 | 1.30 | -0.84 | true |
| Thailand | 0.75 | 4.96 | 3.45 | 4.31 | 0.02 | 0.45 | 0.25 | 0.45 | 0.22 | 1.57 | 0.14 | 0.14 | 0.37 | 0.23 | 1.42 | Benef. | 2.08 | 0.59 | 0.60 | true |
| Tunisia | 0.70 | 3.41 | 6.63 | 4.71 | 0.18 | 0.15 | 0.11 | 0.17 | 0.06 | 1.73 | 0.28 | 0.23 | 0.33 | 0.22 | 0.56 | Benef. | 0.74 | 5.86 | -0.03 | true |
| Argentina | 0.83 | 5.99 | 3.20 | -0.52 | 0.04 | 0.48 | 0.30 | 0.49 | 0.21 | 1.59 | 0.10 | 0.09 | 0.37 | 0.23 | 1.36 | Benef. | 2.23 | 1.15 | -1.65 | true |
| Botswana | 0.66 | 4.07 | 7.80 | 3.43 | 0.02 | 0.34 | 0.12 | 0.35 | 0.23 | 1.57 | 0.28 | 0.27 | 0.38 | 0.24 | 1.43 | Benef. | 1.63 | 0.44 | 0.40 | true |
| Chile | 0.82 | 6.19 | 3.41 | 5.38 | 0.07 | 0.47 | 0.33 | 0.49 | 0.18 | 1.63 | 0.13 | 0.10 | 0.42 | 0.24 | 1.19 | Benef. | 2.20 | 1.84 | -0.30 | true |
| Costa Rica | 0.81 | 5.88 | 5.07 | 1.66 | 0.08 | 0.45 | 0.40 | 0.47 | 0.09 | 1.65 | 0.17 | 0.14 | 0.52 | 0.25 | 1.11 | Benef. | 2.10 | 2.80 | -0.14 | true |
| Hungary | 0.81 | 6.73 | 4.58 | 5.15 | 0.14 | 0.39 | 0.29 | 0.43 | 0.15 | 1.71 | 0.17 | 0.13 | 0.40 | 0.24 | 0.76 | Benef. | 1.86 | 3.60 | -0.09 | true |
| Malaysia | 0.76 | 5.38 | 4.26 | 8.30 | 0.25 | 0.59 | 0.19 | 0.62 | 0.44 | 1.75 | 0.20 | 0.15 | 0.33 | 0.22 | 0.19 | Benef. | 2.62 | 1.35 | -0.67 | true |
| Mauritius | 0.75 | 4.97 | 3.25 | 8.02 | 0.65 | 0.29 | 0.35 | 0.48 | 0.15 | 1.54 | 0.13 | 0.13 | 0.47 | 0.25 | -0.93 | Benef. | 1.41 | 9.33 | -0.03 | false |
| Mexico | 0.78 | 5.17 | 4.53 | 6.86 | 0.11 | 0.14 | 0.31 | 0.17 | -0.13 | 1.67 | 0.18 | 0.14 | 0.43 | 0.25 | 0.97 | Benef. | 0.72 | 11.33 | -0.01 | true |
| Poland | 0.82 | 6.38 | 5.06 | 4.00 | 0.14 | 0.40 | 0.28 | 0.43 | 0.16 | 1.71 | 0.18 | 0.14 | 0.40 | 0.24 | 0.76 | Benef. | 1.88 | 3.93 | -0.08 | true |
| South Africa | 0.74 | 5.73 | 6.94 | 3.08 | 0.10 | 0.63 | 0.22 | 0.64 | 0.44 | 1.67 | 0.25 | 0.21 | 0.42 | 0.24 | 1.02 | Benef. | 2.72 | 1.14 | -1.58 | true |
| Turkey | 0.71 | 5.20 | 3.17 | 7.22 | 0.08 | 0.09 | 0.12 | 0.09 | -0.02 | 1.65 | 0.18 | 0.15 | 0.26 | 0.19 | 1.11 | Benef. | 0.44 | 3.98 | -0.03 | true |
| Uruguay | 0.82 | 6.24 | 3.03 | -1.27 | 0.07 | 0.41 | 0.36 | 0.43 | 0.10 | 1.63 | 0.12 | 0.09 | 0.43 | 0.25 | 1.18 | Benef. | 1.95 | 2.89 | -0.13 | true |
| Venezuela | 0.77 | 4.78 | 5.01 | 3.21 | 0.04 | 0.60 | 0.26 | 0.61 | 0.36 | 1.59 | 0.17 | 0.16 | 0.41 | 0.24 | 1.35 | Benef. | 2.64 | 1.41 | -0.58 | true |

ASEExp: Adjusted savings: education expenditure (% of GNI) 2000

**$d_h$ = 0.05**

$m' = (1+m)/ (0.65 + m^2)$

Deriv-PSIzero = 1.538

**Table 6: Optimal level of human capital when the destination country is the Average Northern Countries**

| $\tilde{\vartheta}^{s*}$ (Average Northern Countries) | | | | | | |
|---|---|---|---|---|---|---|
| | Northern Countries (Destination) | | | | | |
| m | 0 | 0.1 | 0.33 | 0.5 | 0.75 | 1 |
| Albania | 6.01 | 7.817 | 11.972 | 15.044 | 19.560 | 24.077 |
| Algeria | -0.20 | 0.195 | 1.096 | 1.762 | 2.741 | 3.739 |
| Azerbaijan | 2.85 | 4.727 | 9.038 | 12.224 | 16.909 | 21.686 |
| Bangladesh | 1.14 | 4.004 | 10.584 | 15.447 | 22.599 | 29.989 |
| Brazil | 4.71 | 5.831 | 8.402 | 10.302 | 13.096 | 15.853 |
| Bulgaria | 5.90 | 7.208 | 10.216 | 12.439 | 15.708 | 18.929 |
| China | 5.25 | 8.047 | 14.477 | 19.230 | 26.219 | 33.331 |
| Colombia | 3.66 | 4.582 | 6.714 | 8.289 | 10.606 | 12.894 |
| Côte d'Ivoire | 0.09 | 1.545 | 4.892 | 7.366 | 11.005 | 14.765 |
| Ecuador | 17.69 | 23.027 | 35.297 | 44.366 | 57.704 | 71.094 |
| Ethiopia | -0.55 | 0.857 | 4.099 | 6.496 | 10.021 | 13.680 |
| Georgia | 7.01 | 9.396 | 14.888 | 18.948 | 24.918 | 30.921 |
| Ghana | 0.12 | 1.745 | 5.475 | 8.231 | 12.286 | 16.478 |
| India | 1.30 | 2.804 | 6.258 | 8.811 | 12.565 | 16.413 |
| Indonesia | 11.92 | 17.349 | 29.839 | 39.070 | 52.646 | 66.439 |
| Iran | 3.73 | 4.731 | 7.024 | 8.719 | 11.211 | 13.680 |
| Jordan | 3.41 | 4.406 | 6.702 | 8.399 | 10.894 | 13.376 |
| Kenya | -0.55 | 0.403 | 2.586 | 4.200 | 6.573 | 9.033 |
| Malaysia | 3.10 | 3.568 | 4.645 | 5.441 | 6.612 | 7.722 |
| Mexico | 4.48 | 5.275 | 7.109 | 8.464 | 10.457 | 12.386 |
| Morocco | 0.88 | 1.794 | 3.885 | 5.431 | 7.705 | 10.022 |
| Pakistan | 5.26 | 8.256 | 15.137 | 20.224 | 27.705 | 35.328 |
| Peru | 4.51 | 6.341 | 10.557 | 13.673 | 18.256 | 22.882 |
| Philippines | 2.57 | 4.457 | 8.794 | 12.000 | 16.714 | 21.529 |
| Romania | 3.67 | 5.225 | 8.796 | 11.436 | 15.318 | 19.236 |
| Russian Federation | 5.12 | 6.366 | 9.227 | 11.342 | 14.452 | 17.528 |
| Serbia & Monte-negro | 3.29 | 5.026 | 9.014 | 11.962 | 16.297 | 20.697 |
| South Africa | 2.21 | 3.264 | 5.680 | 7.465 | 10.091 | 12.740 |
| Tajikistan | 1.49 | 3.808 | 9.141 | 13.083 | 18.880 | 24.850 |
| Tanzania | -0.08 | 3.113 | 10.449 | 15.871 | 23.845 | 32.124 |
| Thailand | 3.26 | 4.251 | 6.540 | 8.232 | 10.720 | 13.198 |
| Ukraine | 1.58 | 2.629 | 5.054 | 6.847 | 9.482 | 12.158 |
| Vietnam | 0.63 | 2.090 | 5.440 | 7.916 | 11.557 | 15.306 |
| Yemen | 0.58 | 1.158 | 2.496 | 3.486 | 4.941 | 6.414 |

**Table 7: Standard Deviation of the optimal level of human capital for the Average Northern Countries as Destination**

| $\tilde{\vartheta}^{s*}$ (Standard Deviation) | | | | | |
|---|---|---|---|---|---|
| | Northern Countries (Destination) | | | | |
| m | 0.1 | 0.33 | 0.5 | 0.75 | 1 |
| Albania | 0.453 | 1.496 | 2.267 | 3.400 | 4.534 |
| Algeria | 0.085 | 0.282 | 0.427 | 0.640 | 0.902 |
| Azerbaijan | 0.409 | 1.348 | 2.043 | 3.064 | 4.317 |
| Bangladesh | 0.556 | 1.835 | 2.780 | 4.170 | 6.213 |
| Brazil | 0.305 | 1.008 | 1.527 | 2.290 | 2.974 |
| Bulgaria | 0.361 | 1.192 | 1.806 | 2.709 | 3.507 |
| China | 0.618 | 2.041 | 3.092 | 4.639 | 6.494 |
| Colombia | 0.252 | 0.831 | 1.259 | 1.888 | 2.455 |
| Côte d'Ivoire | 0.283 | 0.933 | 1.414 | 2.121 | 3.161 |
| Ecuador | 1.303 | 4.298 | 6.513 | 9.769 | 13.152 |
| Ethiopia | 0.263 | 0.868 | 1.315 | 1.972 | 3.006 |
| Georgia | 0.577 | 1.903 | 2.883 | 4.324 | 5.845 |
| Ghana | 0.314 | 1.035 | 1.568 | 2.351 | 3.514 |
| India | 0.313 | 1.033 | 1.566 | 2.349 | 3.378 |
| Indonesia | 1.215 | 4.011 | 6.077 | 9.115 | 12.698 |
| Iran | 0.266 | 0.877 | 1.329 | 1.994 | 2.607 |
| Jordan | 0.260 | 0.859 | 1.301 | 1.951 | 2.570 |
| Kenya | 0.180 | 0.593 | 0.899 | 1.349 | 2.038 |
| Malaysia | 0.159 | 0.524 | 0.794 | 1.191 | 1.474 |
| Mexico | 0.243 | 0.802 | 1.216 | 1.824 | 2.303 |
| Morocco | 0.198 | 0.655 | 0.992 | 1.489 | 2.096 |
| Pakistan | 0.654 | 2.159 | 3.271 | 4.907 | 6.905 |
| Peru | 0.431 | 1.422 | 2.155 | 3.233 | 4.414 |
| Philippines | 0.406 | 1.338 | 2.028 | 3.041 | 4.312 |
| Romania | 0.365 | 1.205 | 1.826 | 2.739 | 3.740 |
| Russian Federation | 0.336 | 1.108 | 1.678 | 2.517 | 3.280 |
| Serbia & Monte-negro | 0.391 | 1.291 | 1.956 | 2.933 | 4.073 |
| South Africa | 0.248 | 0.818 | 1.240 | 1.860 | 2.536 |
| Tajikistan | 0.464 | 1.532 | 2.321 | 3.482 | 5.109 |
| Tanzania | 0.593 | 1.958 | 2.967 | 4.450 | 6.792 |
| Thailand | 0.257 | 0.848 | 1.284 | 1.927 | 2.545 |
| Ukraine | 0.237 | 0.783 | 1.186 | 1.779 | 2.473 |
| Vietnam | 0.293 | 0.966 | 1.464 | 2.197 | 3.216 |
| Yemen | 0.134 | 0.441 | 0.669 | 1.003 | 1.382 |

**Table 8: Optimal level of human capital when the destination country is the Middle East**

| $\tilde{\vartheta}^{s*}$ (Average Middle East) | | | | | | |
|---|---|---|---|---|---|---|
| | Middle East | | | | | |
| m | 0 | 0.1 | 0.33 | 0.5 | 0.75 | 1 |
| Albania | 6.01 | 6.710 | 8.318 | 9.507 | 11.255 | 13.003 |
| Algeria | -0.20 | -0.014 | 0.408 | 0.719 | 1.178 | 1.636 |
| Azerbaijan | 2.85 | 3.729 | 5.745 | 7.235 | 9.426 | 11.617 |
| Bahrain | 6.84 | 7.769 | 9.917 | 11.504 | 13.838 | 16.171 |
| Brazil | 4.71 | 5.086 | 5.941 | 6.573 | 7.502 | 8.431 |
| Bulgaria | 5.90 | 6.325 | 7.304 | 8.028 | 9.092 | 10.156 |
| China | 5.25 | 6.536 | 9.492 | 11.677 | 14.889 | 18.102 |
| Colombia | 3.66 | 3.967 | 4.685 | 5.215 | 5.995 | 6.774 |
| Côte d'Ivoire | 0.09 | 0.854 | 2.613 | 3.912 | 5.824 | 7.735 |
| Ecuador | 17.69 | 19.846 | 24.799 | 28.460 | 33.844 | 39.229 |
| Ethiopia | -0.55 | 0.214 | 1.980 | 3.285 | 5.204 | 7.122 |
| Georgia | 7.01 | 7.988 | 10.242 | 11.907 | 14.357 | 16.806 |
| Ghana | 0.12 | 0.979 | 2.948 | 4.403 | 6.543 | 8.683 |
| India | 1.30 | 2.039 | 3.734 | 4.987 | 6.829 | 8.671 |
| Indonesia | 11.92 | 14.380 | 20.043 | 24.228 | 30.383 | 36.537 |
| Iran | 3.73 | 4.082 | 4.881 | 5.472 | 6.341 | 7.210 |
| Jordan | 3.41 | 3.771 | 4.605 | 5.222 | 6.129 | 7.036 |
| Kenya | -0.55 | -0.036 | 1.137 | 2.004 | 3.279 | 4.554 |
| Malaysia | 3.10 | 3.180 | 3.365 | 3.502 | 3.703 | 3.904 |
| Mexico | 4.48 | 4.682 | 5.149 | 5.494 | 6.002 | 6.510 |
| Morocco | 0.88 | 1.309 | 2.286 | 3.007 | 4.069 | 5.131 |
| Pakistan | 5.26 | 6.658 | 9.864 | 12.235 | 15.720 | 19.206 |
| Peru | 4.51 | 5.288 | 7.083 | 8.410 | 10.361 | 12.312 |
| Philippines | 2.57 | 3.466 | 5.526 | 7.048 | 9.286 | 11.525 |
| Romania | 3.67 | 4.333 | 5.852 | 6.976 | 8.628 | 10.280 |
| Russian Federation | 5.12 | 5.546 | 6.522 | 7.243 | 8.305 | 9.366 |
| Serbia & Montenegro | 3.29 | 4.070 | 5.862 | 7.186 | 9.133 | 11.080 |
| South Africa | 2.21 | 2.659 | 3.681 | 4.437 | 5.548 | 6.660 |
| Tajikistan | 1.49 | 2.674 | 5.400 | 7.414 | 10.376 | 13.338 |
| Tanzania | -0.08 | 1.664 | 5.666 | 8.625 | 12.976 | 17.327 |
| Thailand | 3.26 | 3.624 | 4.470 | 5.095 | 6.014 | 6.934 |
| Ukraine | 1.58 | 2.050 | 3.143 | 3.950 | 5.138 | 6.325 |
| Vietnam | 0.63 | 1.375 | 3.080 | 4.340 | 6.193 | 8.045 |
| Yemen | 0.58 | 0.831 | 1.419 | 1.853 | 2.491 | 3.130 |

**Table 9: Standard Deviation of the optimal level of human capital for the Middle East as Destination**

| $\tilde{\vartheta}^{s*}$ (Standard deviation) | | | | | |
|---|---|---|---|---|---|
| | Middle East | | | | |
| m | 0.1 | 0.33 | 0.5 | 0.75 | 1 |
| Albania | 0.222 | 0.732 | 1.108 | 1.663 | 2.217 |
| Algeria | 0.042 | 0.138 | 0.209 | 0.313 | 0.417 |
| Azerbaijan | 0.200 | 0.659 | 0.999 | 1.498 | 1.997 |
| Bahrain | 0.272 | 0.897 | 1.359 | 2.039 | 2.718 |
| Brazil | 0.149 | 0.493 | 0.747 | 1.120 | 1.493 |
| Bulgaria | 0.177 | 0.583 | 0.883 | 1.325 | 1.766 |
| China | 0.302 | 0.998 | 1.512 | 2.268 | 3.024 |
| Colombia | 0.123 | 0.406 | 0.615 | 0.923 | 1.231 |
| Côte d'Ivoire | 0.138 | 0.456 | 0.691 | 1.037 | 1.383 |
| Ecuador | 0.637 | 2.102 | 3.184 | 4.776 | 6.369 |
| Ethiopia | 0.129 | 0.424 | 0.643 | 0.964 | 1.286 |
| Georgia | 0.282 | 0.930 | 1.409 | 2.114 | 2.819 |
| Ghana | 0.153 | 0.506 | 0.766 | 1.150 | 1.533 |
| India | 0.153 | 0.505 | 0.766 | 1.148 | 1.531 |
| Indonesia | 0.594 | 1.961 | 2.971 | 4.457 | 5.943 |
| Iran | 0.130 | 0.429 | 0.650 | 0.975 | 1.300 |
| Jordan | 0.127 | 0.420 | 0.636 | 0.954 | 1.272 |
| Kenya | 0.088 | 0.290 | 0.440 | 0.659 | 0.879 |
| Malaysia | 0.078 | 0.256 | 0.388 | 0.582 | 0.776 |
| Mexico | 0.119 | 0.392 | 0.594 | 0.892 | 1.189 |
| Morocco | 0.097 | 0.320 | 0.485 | 0.728 | 0.971 |
| Pakistan | 0.320 | 1.056 | 1.599 | 2.399 | 3.199 |
| Peru | 0.211 | 0.695 | 1.054 | 1.581 | 2.107 |
| Philippines | 0.198 | 0.654 | 0.991 | 1.487 | 1.983 |
| Romania | 0.179 | 0.589 | 0.893 | 1.339 | 1.786 |
| Russian Federation | 0.164 | 0.542 | 0.820 | 1.231 | 1.641 |
| Serbia & Montenegro | 0.191 | 0.631 | 0.956 | 1.434 | 1.912 |
| South Africa | 0.121 | 0.400 | 0.606 | 0.909 | 1.213 |
| Tajikistan | 0.227 | 0.749 | 1.135 | 1.702 | 2.270 |
| Tanzania | 0.290 | 0.957 | 1.451 | 2.176 | 2.901 |
| Thailand | 0.126 | 0.414 | 0.628 | 0.942 | 1.256 |
| Ukraine | 0.116 | 0.383 | 0.580 | 0.870 | 1.160 |
| Vietnam | 0.143 | 0.473 | 0.716 | 1.074 | 1.432 |
| Yemen | 0.065 | 0.216 | 0.327 | 0.490 | 0.654 |

**Figures 1: Trends in $H/H_0$ for source countries when the average reference countries is the country of destination ($\alpha$ =0.1)**

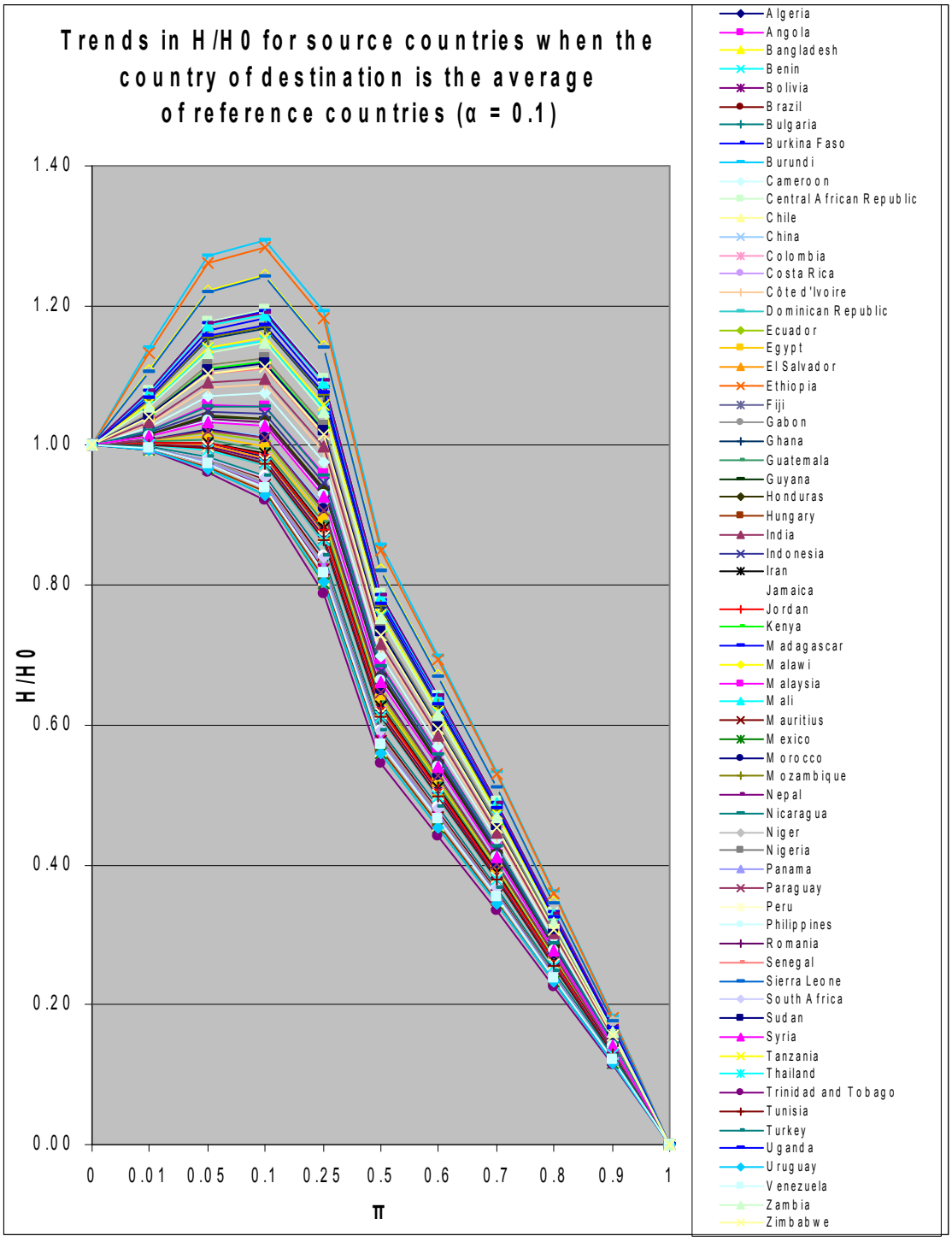


**Figure 2: Trends in $H/H_0$ for source countries when the average reference countries is the country of destination ($\alpha$ =0.2)**

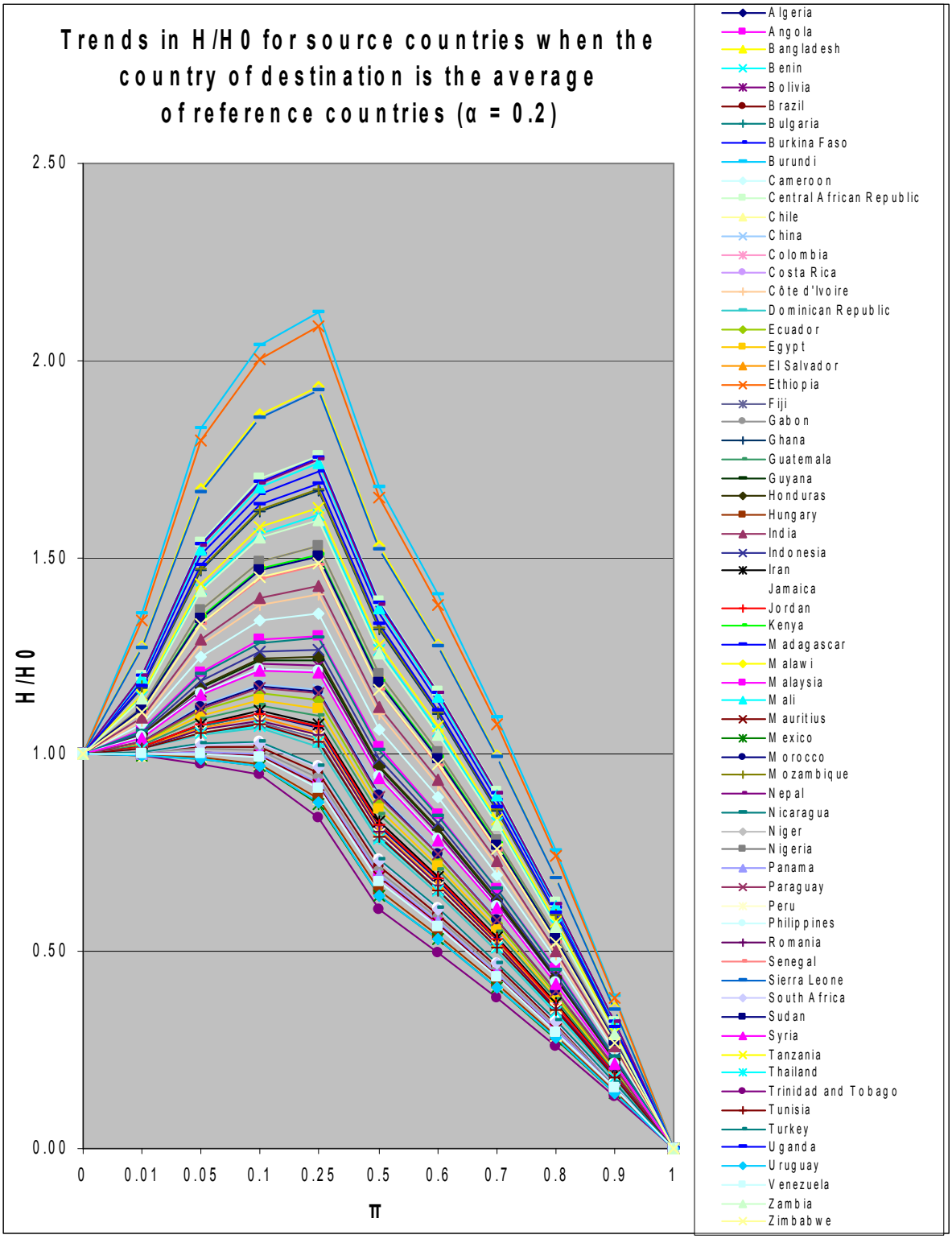


**Figure 3: Trends in $H/H_0$ for source countries when the average reference countries is the country of destination ($\alpha$ =0.3)**

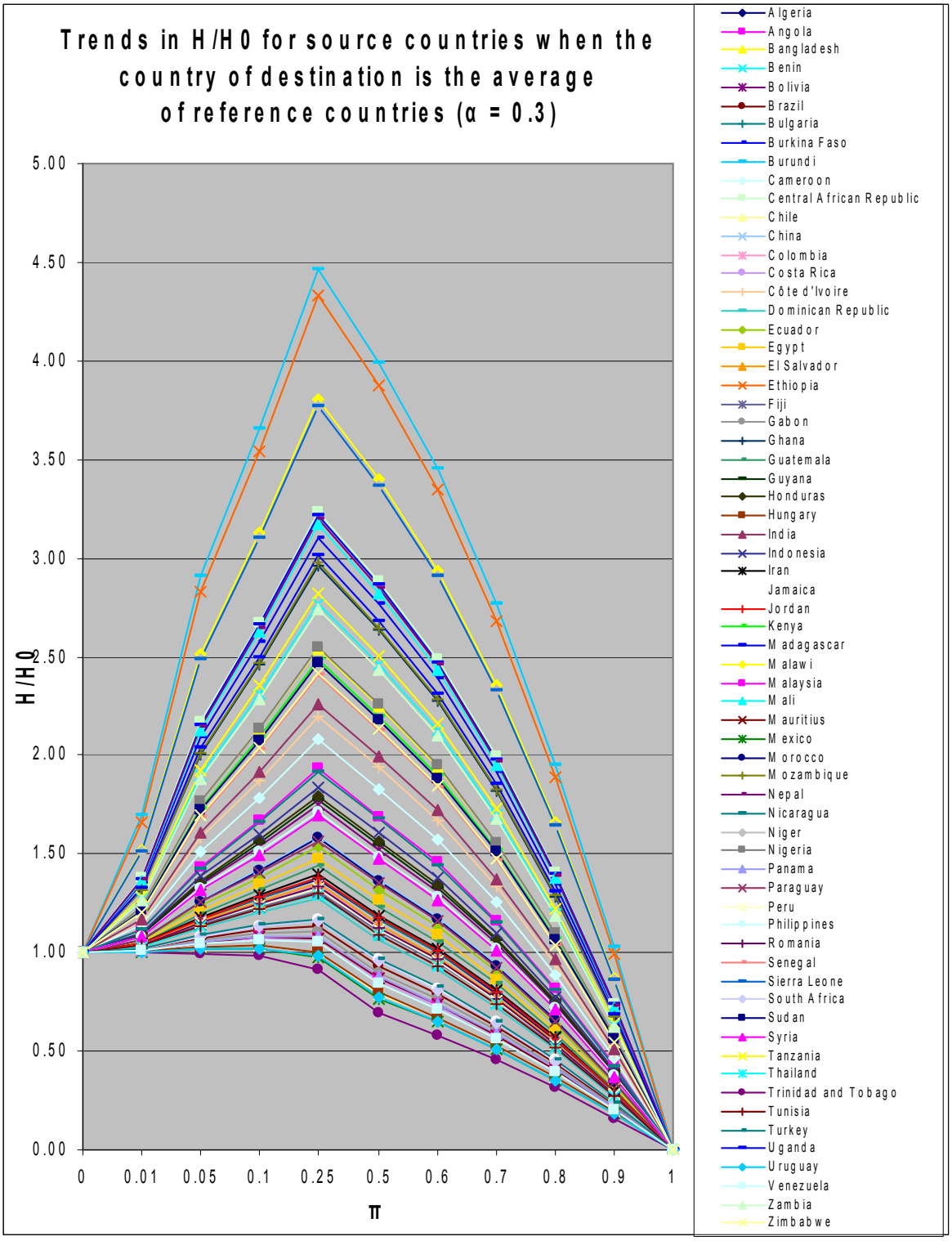


**Figure 4: Trends in $H/H_0$ for source countries when the average reference countries is the country of destination ($\alpha$ =0.4)**

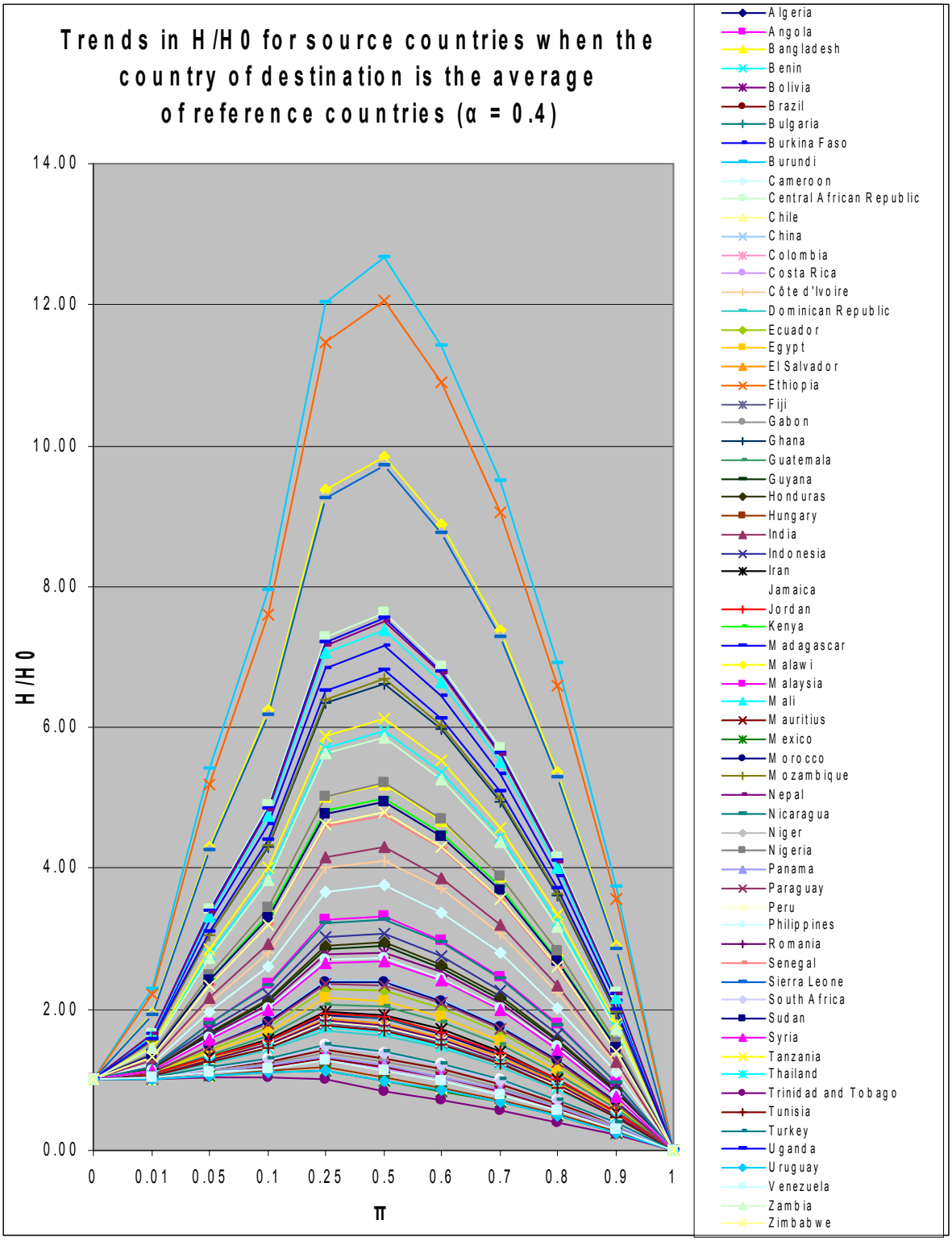


**Figure 5: Trends in $H/H_0$ for source countries when the average reference countries is the country of destination ($\alpha$ =0.5)**

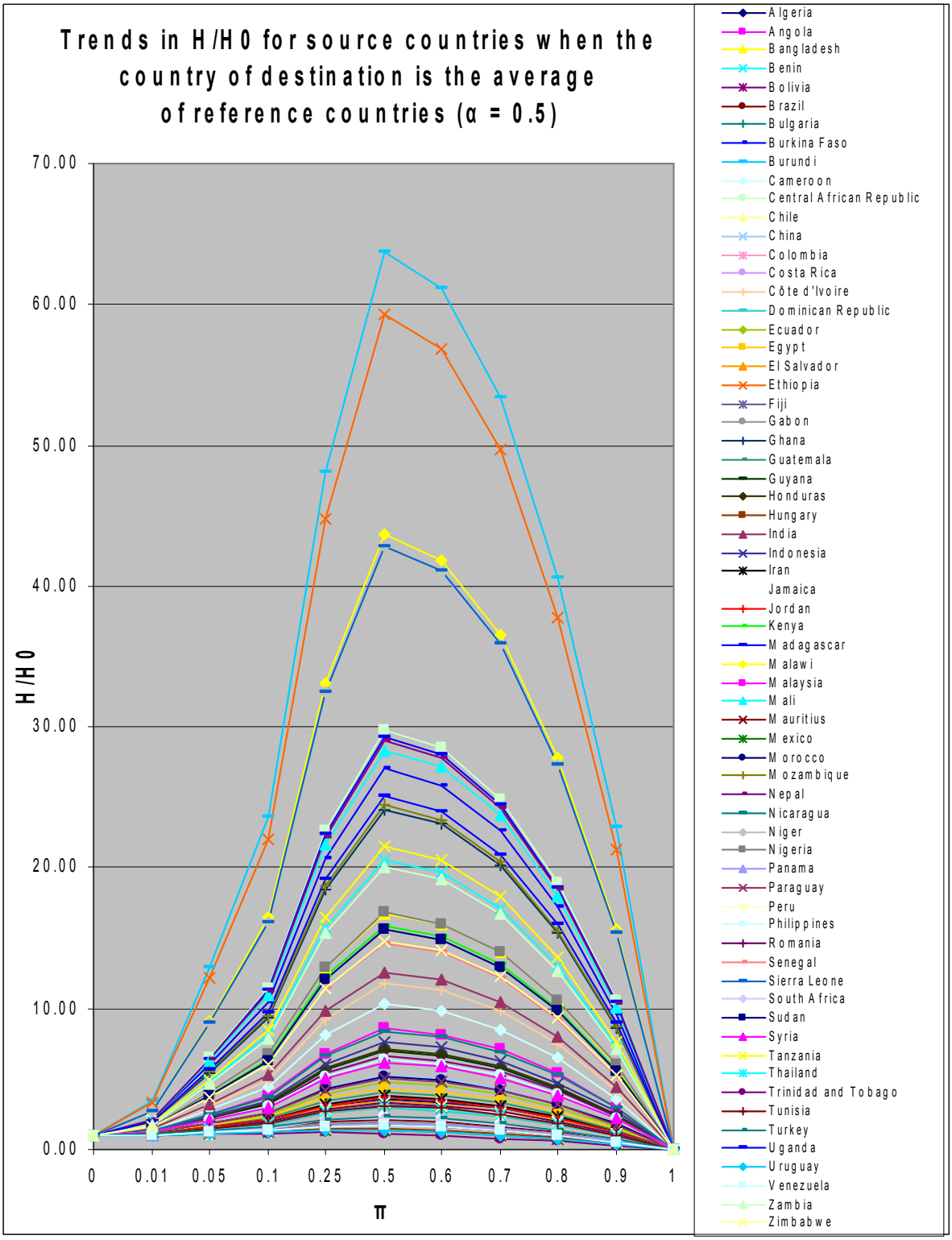
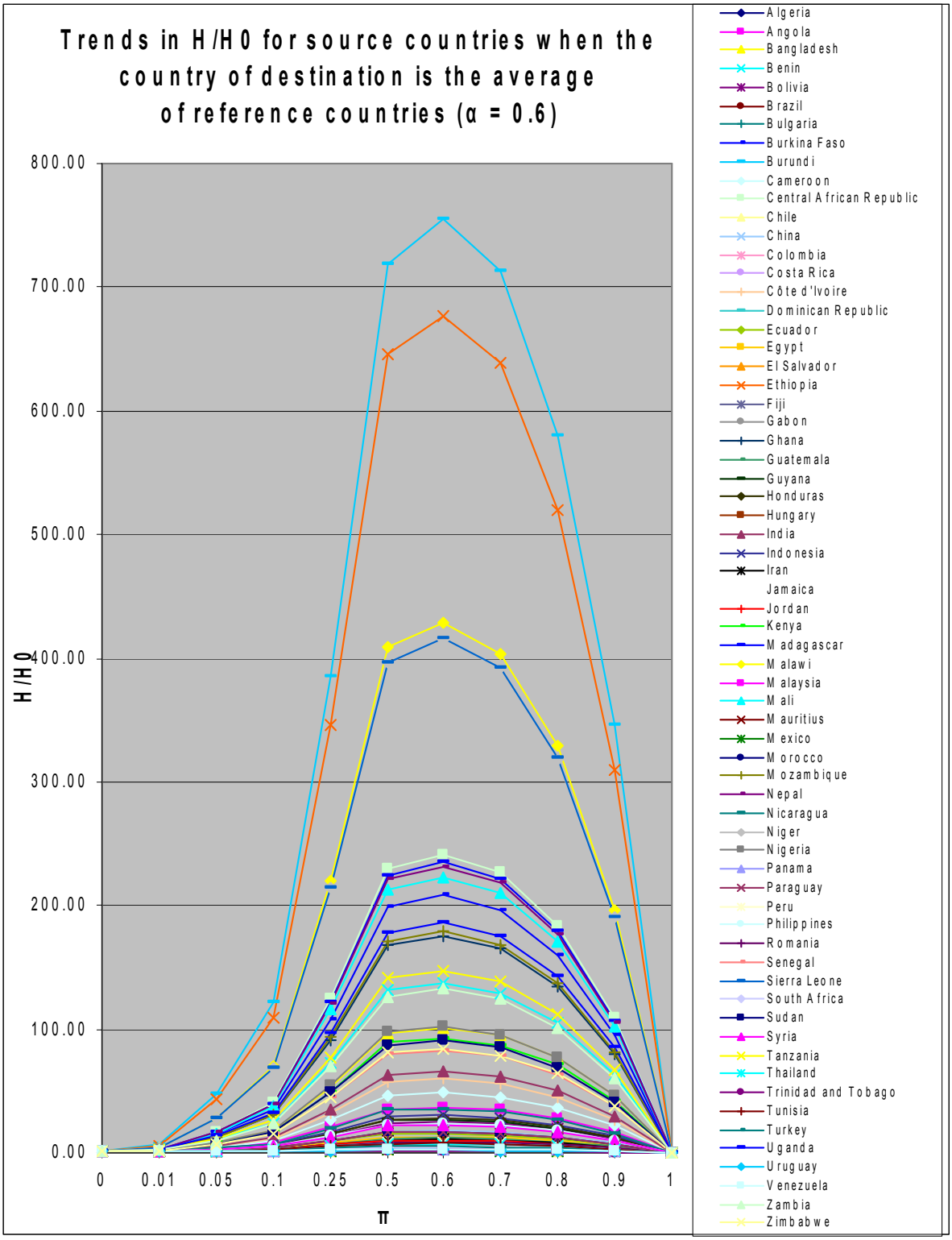


**Figure 6: Trends in $H/H_0$ for source countries when the average reference countries is the country of destination ($\alpha$ =0.6)**



## Table 10: Trends in Human Capital Level given different α

| Country | π | H/H0 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | α = 0.1 | α = 0.2 | α = 0.28 | α = 0.3 | α = 0.4 | α = 0.5 | α = 0.6 | α = 0.7 | α = 0.8 |
| Algeria | 0.18 | 0.93 | 1.10 | 1.29 | 1.36 | 1.79 | 2.65 | 4.78 | 12.72 | 90.18 |
| Angola | 0.54 | 0.64 | 0.96 | 1.43 | 1.61 | 3.21 | 8.48 | 36.38 | 411.65 | 52712.56 |
| Bangladesh | 0.02 | 1.08 | 1.21 | 1.37 | 1.42 | 1.74 | 2.32 | 3.58 | 7.34 | 30.96 |
| Benin | 0.10 | 1.15 | 1.55 | 2.10 | 2.28 | 3.82 | 7.85 | 23.13 | 140.11 | 5139.21 |
| Bolivia | 0.03 | 1.03 | 1.12 | 1.21 | 1.24 | 1.43 | 1.74 | 2.33 | 3.78 | 10.02 |
| Brazil | 0.02 | 0.99 | 1.01 | 1.03 | 1.03 | 1.07 | 1.12 | 1.19 | 1.33 | 1.65 |
| Bulgaria | 0.06 | 1.00 | 1.09 | 1.18 | 1.21 | 1.39 | 1.70 | 2.29 | 3.76 | 10.18 |
| Burkina Faso | 0.14 | 1.17 | 1.72 | 2.53 | 2.82 | 5.48 | 13.86 | 55.71 | 566.33 | 58527.49 |
| Burundi | 0.35 | 1.07 | 2.00 | 3.73 | 4.46 | 13.00 | 58.14 | 549.69 | 23236.47 | 41521893.56 |
| Cameroon | 0.20 | 1.02 | 1.38 | 1.87 | 2.03 | 3.41 | 7.03 | 20.84 | 127.39 | 4758.75 |
| Central African Republic | 0.26 | 1.08 | 1.75 | 2.83 | 3.25 | 7.40 | 23.44 | 132.21 | 2363.20 | 755004.94 |
| Chile | 0.08 | 0.95 | 0.98 | 1.02 | 1.03 | 1.10 | 1.21 | 1.39 | 1.74 | 2.75 |
| China | 0.03 | 1.02 | 1.10 | 1.18 | 1.20 | 1.35 | 1.61 | 2.07 | 3.16 | 7.38 |
| Colombia | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.01 | 1.01 | 1.01 | 1.02 | 1.04 |
| Costa Rica | 0.04 | 0.98 | 1.01 | 1.03 | 1.04 | 1.09 | 1.16 | 1.27 | 1.48 | 2.02 |
| Côte d'Ivoire | 0.10 | 1.09 | 1.38 | 1.74 | 1.86 | 2.79 | 4.90 | 11.43 | 46.85 | 786.96 |
| Dominican Republic | 0.13 | 0.95 | 1.07 | 0.56 | 1.24 | 1.50 | 1.97 | 2.98 | 5.89 | 23.12 |
| Ecuador | 0.07 | 1.02 | 1.13 | 1.20 | 1.30 | 1.56 | 2.02 | 2.98 | 5.67 | 20.58 |
| Egypt | 0.05 | 1.01 | 1.09 | 1.26 | 1.20 | 1.37 | 1.63 | 2.14 | 3.34 | 8.20 |
| El Salvador | 0.16 | 0.94 | 1.09 | 1.18 | 1.32 | 1.71 | 2.43 | 4.14 | 10.07 | 59.53 |
| Ethiopia | 0.21 | 1.22 | 2.10 | 1.27 | 4.25 | 10.86 | 40.37 | 289.41 | 7712.85 | 5477818.11 |
| Fiji | 0.62 | 0.48 | 0.63 | 3.64 | 0.91 | 1.48 | 2.92 | 8.09 | 44.23 | 1320.53 |
| Gabon | 0.25 | 0.83 | 0.94 | 0.84 | 1.10 | 1.37 | 1.86 | 2.93 | 6.26 | 28.53 |
| Ghana | 0.46 | 0.83 | 1.40 | 1.07 | 2.75 | 6.79 | 23.99 | 159.37 | 3741.69 | 2062553.71 |
| Guatemala | 0.11 | 0.99 | 1.13 | 2.37 | 1.34 | 1.68 | 2.31 | 3.72 | 8.25 | 40.48 |
| Guyana | 0.83 | 0.24 | 0.37 | 1.29 | 0.65 | 1.36 | 3.83 | 18.14 | 242.50 | 43348.22 |
| Honduras | 0.12 | 1.03 | 1.26 | 0.57 | 1.63 | 2.31 | 3.74 | 7.73 | 25.92 | 291.11 |
| Hungary | 0.10 | 0.94 | 0.98 | 1.54 | 1.04 | 1.12 | 1.24 | 1.46 | 1.90 | 3.24 |
| India | 0.03 | 1.07 | 1.22 | 1.02 | 1.44 | 1.79 | 2.43 | 3.86 | 8.31 | 38.56 |
| Indonesia | 0.02 | 1.03 | 1.09 | 1.39 | 1.18 | 1.31 | 1.52 | 1.89 | 2.72 | 5.64 |
| Iran | 0.18 | 0.94 | 1.11 | 1.16 | 1.38 | 1.84 | 2.75 | 5.04 | 13.80 | 103.68 |
| Jamaica | 0.82 | 0.22 | 0.29 | 1.31 | 0.41 | 0.66 | 1.26 | 3.31 | 16.68 | 423.07 |
| Jordan | 0.03 | 1.01 | 1.06 | 0.38 | 1.12 | 1.22 | 1.37 | 1.63 | 2.18 | 3.90 |
| Kenya | 0.36 | 0.91 | 1.40 | 1.11 | 2.46 | 5.19 | 14.77 | 70.93 | 969.76 | 181268.79 |
| Madagascar | 0.13 | 1.18 | 1.74 | 2.17 | 2.86 | 5.53 | 13.97 | 55.99 | 566.44 | 57968.87 |
| Malawi | 0.18 | 1.21 | 1.95 | 2.56 | 3.63 | 8.28 | 26.31 | 149.00 | 2681.15 | 868189.78 |
| Malaysia | 0.08 | 0.96 | 1.00 | 3.16 | 1.07 | 1.16 | 1.30 | 1.54 | 2.06 | 3.65 |
| Mali | 0.20 | 1.14 | 1.76 | 1.05 | 3.08 | 6.49 | 18.44 | 88.41 | 1204.84 | 223755.50 |
| Mauritius | 0.53 | 0.54 | 0.65 | 2.72 | 0.82 | 1.13 | 1.76 | 3.42 | 10.35 | 94.74 |
| Mexico | 0.06 | 0.96 | 0.99 | 0.78 | 1.02 | 1.06 | 1.13 | 1.24 | 1.44 | 1.95 |
| Morocco | 0.19 | 0.96 | 1.18 | 1.01 | 1.56 | 2.24 | 3.74 | 8.06 | 28.95 | 373.94 |
| Mozambique | 0.47 | 0.81 | 1.38 | 1.46 | 2.73 | 6.80 | 24.38 | 165.66 | 4037.94 | 2399007.53 |
| Nepal | 0.02 | 1.13 | 1.34 | 2.34 | 1.69 | 2.28 | 3.49 | 6.60 | 19.09 | 159.48 |
| Nicaragua | 0.15 | 1.03 | 1.32 | 1.60 | 1.80 | 2.74 | 4.92 | 11.86 | 51.38 | 963.89 |
| Niger | 0.11 | 1.24 | 1.86 | 1.68 | 3.15 | 6.33 | 16.84 | 73.05 | 842.92 | 112240.01 |
| Nigeria | 0.08 | 1.13 | 1.46 | 2.80 | 2.04 | 3.18 | 5.94 | 15.11 | 71.73 | 1616.09 |
| Panama | 0.13 | 0.92 | 0.99 | 1.89 | 1.09 | 1.24 | 1.48 | 1.94 | 3.04 | 7.44 |
| Paraguay | 0.02 | 1.02 | 1.06 | 1.07 | 1.13 | 1.22 | 1.36 | 1.61 | 2.12 | 3.69 |
| Peru | 0.06 | 1.00 | 1.06 | 1.11 | 1.16 | 1.30 | 1.53 | 1.95 | 2.91 | 6.51 |
| Philippines | 0.17 | 1.00 | 1.24 | 1.14 | 1.65 | 2.40 | 4.08 | 9.03 | 33.90 | 477.92 |
| Romania | 0.09 | 0.98 | 1.08 | 1.55 | 1.23 | 1.44 | 1.82 | 2.56 | 4.56 | 14.37 |
| Senegal | 0.29 | 0.98 | 1.45 | 1.19 | 2.42 | 4.76 | 12.29 | 50.95 | 545.38 | 62495.29 |
| Sierra Leone | 0.33 | 1.04 | 1.83 | 2.16 | 3.78 | 9.93 | 38.37 | 291.39 | 8548.74 | 7357801.77 |
| South Africa | 0.10 | 0.95 | 1.03 | 3.22 | 1.13 | 1.29 | 1.55 | 2.03 | 3.19 | 7.89 |
| Sudan | 0.07 | 1.12 | 1.40 | 1.11 | 1.86 | 2.73 | 4.67 | 10.43 | 39.88 | 582.69 |

| Country | π | H/H0 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | α = 0.1 | α = 0.2 | α = 0.28 | α = 0.3 | α = 0.4 | α = 0.5 | α = 0.6 | α = 0.7 | α = 0.8 |
| Syria | 0.04 | 1.03 | 1.14 | 1.75 | 1.29 | 1.52 | 1.92 | 2.72 | 4.88 | 15.62 |
| Tanzania | 0.42 | 0.87 | 1.43 | 1.25 | 2.71 | 6.36 | 21.01 | 126.28 | 2508.48 | 989848.27 |
| Thailand | 0.02 | 1.00 | 1.03 | 2.35 | 1.06 | 1.11 | 1.18 | 1.30 | 1.53 | 2.10 |
| Trinidad and Tobago | 0.76 | 0.27 | 0.31 | 1.05 | 0.37 | 0.47 | 0.66 | 1.09 | 2.54 | 13.70 |
| Tunisia | 0.21 | 0.89 | 1.05 | 0.36 | 1.30 | 1.71 | 2.53 | 4.55 | 12.07 | 84.99 |
| Turkey | 0.05 | 0.98 | 1.03 | 1.24 | 1.09 | 1.18 | 1.31 | 1.54 | 2.02 | 3.46 |
| Uganda | 0.37 | 0.95 | 1.57 | 1.07 | 2.98 | 7.04 | 23.45 | 142.55 | 2885.28 | 1182072.38 |
| Uruguay | 0.11 | 0.92 | 0.97 | 2.58 | 1.02 | 1.11 | 1.23 | 1.45 | 1.90 | 3.27 |
| Venezuela | 0.04 | 0.98 | 1.00 | 1.01 | 1.03 | 1.07 | 1.13 | 1.22 | 1.39 | 1.80 |
| Zambia | 0.26 | 1.04 | 1.59 | 1.03 | 2.74 | 5.66 | 15.58 | 71.28 | 898.29 | 142671.26 |
| Zimbabwe | 0.06 | 1.11 | 1.37 | 2.43 | 1.78 | 2.55 | 4.20 | 8.87 | 30.86 | 373.70 |